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GENERAL PRACTICE CLINICS

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EDITORIAL: THE CONCEPT OF MOTION SENSITIVITY

TREATMENT OF BACTERIAL INFECTIONS WITH SULFOGLYCIN — *Werner Anders and Walter Stephan*

EDITORIAL SURVEY: A UNIFIED FIELD OF LIFE

SYMPOSIUM ON MEDICAL HISTORY

WHAT MEDICINE HAS CONTRIBUTED TO THE PROGRESS OF CIVILIZATION — *Henry E. Sigerist*

ANCIENT AND PRIMITIVE DRUGS — *Douglas Guthrie*

THE PHYSICIAN AS ALCHEMIST (Medical Ideas in the Arabian Empire) — *Félix Martí-Ibáñez*

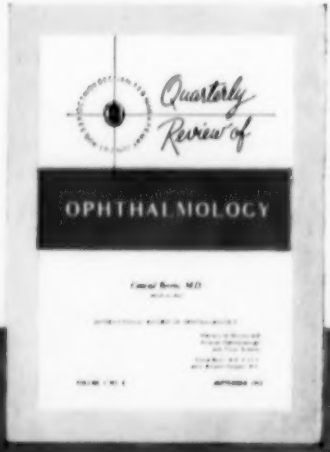
OPHTHALMOLOGY

THE USE OF SUBCONJUNCTIVAL CORNEO-SCLERAL SUTURE IN CATARACT EXTRACTION — *Joaquin Barraquer Moner*

in this issue

QUARTERLY REVIEW OF OPHTHALMOLOGY

Conrad Berens, M.D.
Editor-in-chief



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1. Cass, L. J., and Frederik, W. S.: Ann. New York Acad. Sc. *58*:455 (July 15) 1954.
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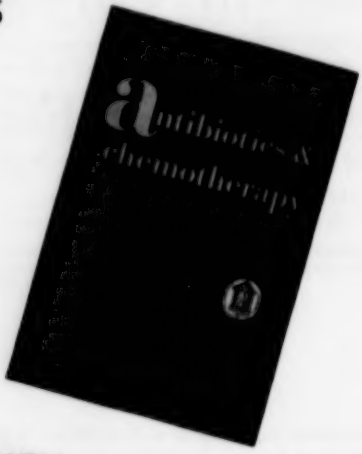

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VOL. 168 NO. 6 • WHOLE NUMBER 2868 • JUNE 1955

EDITORIAL: The Concept of Motion Sensitivity 371

Treatment of Bacterial Infections with Sulfoglycin 378
Werner Anders and Walter Stephan

EDITORIAL SURVEY: A Unified Field of Life 380

SYMPOSIUM ON MEDICAL HISTORY

What Medicine Has Contributed to the Progress of Civilization 383
Henry E. Sigerist

Ancient and Primitive Drugs 392
Douglas Guthrie

The Physician as Alchemist. (Medical Ideas in the Arabian Empire) 399
Félix Martí-Ibáñez

The INTERNATIONAL RECORD OF MEDICINE is honored to announce that beginning with the July issue a new section on Health and Travel will be published in this journal. The proceedings of The First International Symposium on Health and Travel will appear in the July and August issues. The International Council on Health and Travel has appointed the INTERNATIONAL RECORD OF MEDICINE as its official journal, and articles, reports of meetings, and world news on Health and Travel will appear regularly in this journal.

Quarterly Review of **OPHTHALMOLOGY**

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ORIGINAL ARTICLE

The Use of Subconjunctival Corneo-scleral Suture in Cataract Extraction 429
Dr. D. Joaquin Barraquer Moner

OPHTHALMOLOGY ABSTRACTS

Optics, Physiology and Psychology of Vision
The Sensitivity of the Eye to Spectral Radiation at Scotopic and Mesopic Intensity Levels 432
Effect of Flash and Field Luminance upon Human Reaction Time 432
Testing Aniseikonia with a Simplified Space Eikonometer 433
The Nature and Cause of Impaired Vision in the Amblyopic Eye of a Squinter 433
A Note on True and False Image Projection 434
Brightness Difference in Seeing 434

Ocular Movements and Motor Anomalies, Nystagmus Reading Disability
Inducement of Cyclofusional Movements 434
Investigation of the Nature and Cause of Impaired Acuity in Amblyopia 435

Anomalies of Refraction and Accommodation; Contact Lenses
Accommodative Response in Asymmetric Convergence 435
Physiological Factors in Multifocal Corrections. I. Measurement of Ocular Functions 436

Conjunctiva
Epidemic Keratoconjunctivitis 436
The Present Status of Epidemic Keratoconjunctivitis 437

Anterior Chamber and Pupil
The Pupillary Reactions and their Pathology 438

Uveal Tract and Sympathetic Ophthalmitis
A Study of the Role of Toxoplasmosis in Adult Chorioretinitis 438
Sympathetic Ophthalmia 439
Metastatic Carcinoma of the Iris 439

Crystalline Lens
Biologie du cristallin 440
Postnatal Cataracts in Premature Infants; Report of Two Cases 440

Retina
Present Status of Retrolental Fibroplasia 441
The Problems of the Rutin Effect in Diabetic Retinopathy 441
Effect of Oxygen on Developing Retinal Vessels with Particular Reference to the Problem of Retrolental Fibroplasia 441
Pathological Basis of Retrolental Fibroplasia 442

Neuro-ophthalmology Optic Nerve, Visual Pathways, Centers and Visual Field
Optic Atrophy of the Infant Following a Prepartum Hemorrhage 442
Pregnancy Complicated by Ocular Chiasmatic Signs of a Meningioma in the Sella Turcica 443
Tobacco-Alcohol (Toxic) Amblyopia 443
Juvenile Amaurotic Idiocy in Norway 443
A Quantitative Comparison of the Prism-Jump and the Tangent Screen Method of Plotting Scotoma 444

Glaucoma and Hypotony
Routine Tonometry as Part of the Physical Examination 444
Meterologic Influences on Ocular Diseases 445
Carbonic Anhydrase Inhibitor Acetazolemide (Diamox). A New Approach to the Therapy of Glaucoma 445

Medical Ophthalmology
Fundus Lesions with Disseminated Lupus Erythematosus 445
Experimental Diabetes Mellitus and the Eye 446
Ocular Manifestations of Niemann-Pick Disease 446
Retinopathy as Part of a Diabetic Angiopathy 446
The Ocular Symptoms of Acrodynia 446

Pharmacology, Toxicology and Therapeutics
Ocular Penetration of Erythromycin 447
Topical Cortisone in the Treatment of Syphilitic Interstitial Keratitis 447
Treatment of Herpes Zoster Ophthalmicus with Cortisone or Corticotropin 447

BOOK REVIEWS

The New Approach to Optical Dispensing 448
Clinical Manual on Aniseikonia 448

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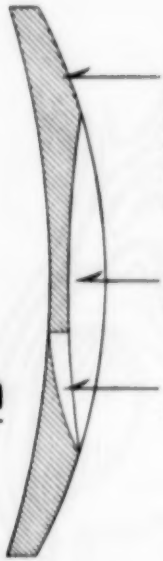
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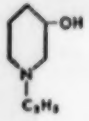

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The Concept of Motion Sensitivity

From the time man lost his footing on firm ground, by riding animals or paddling in dugout canoes, he has found himself at odds with gravity. Sensitivity to motion was built into his organism as securely as his nervous system and endocrine functions.

In a broad philosophical sense, man needs to enjoy a stable spatial relationship with his environment. As Martí-Ibáñez points out, the "earth has been man's focus from the time he first appeared on it, and the emotional realization that the earth is the center, axis, and basis of his existence is more important to man than the intellectual concept that our planet is not the center of the universe."

He adds: "The earth is as much a symbol of stability for the human being as his knowing where he stands at each moment. Maps teach man his position on the planet; guide books give him his location in a city. This visual orientation and intellectual recognition of his geographical placement tell man *where* he is. And to know *where* one is, is, to a certain degree, to know *why* one is there. To know one's location on earth at all times is an indispensable requisite for peace of mind." [1] Although man's intellect may roam anywhere in the universe, his physical organism is bound to one specific point in space.

NO RESPECT FOR "HEROES"

Motion sensitivity is as old as mankind. Hippocrates was clearly aware that movement of the body is connected with the mechanism of emesis, as shown in one of his famous *Aphorisms*.

Motion sickness never respected persons, however historic their mission. Great heroes in literature or in history, no matter how strong-willed, courageous, and sturdy, often fell victim to motion sensitivity. In mythology, Jason and his lusty sailors, in the course of their pursuit of the Golden Fleece, were often seasick, as was Ulysses in his homeric sea wanderings over the "wine-dark" waters of the Mare Nostrum. The legendary legionaries of Julius Caesar, as noted in his "Commentaries," were most human in their sensitivity to *mal de mer*. Seasickness, the dreaded *nausea maris*, cursed Seneca and Cicero to the point where Cicero preferred to face his assassins rather than to expose himself to the rigors of the waves. Seasickness was the scourge of the adventurous Spanish *Conquistadores*, as much as of the sailors on

Columbus' ships, as related by the great Admiral in his diary, and also for Magellan and the Portuguese sailors who accompanied him around the globe.

The brave Lord Nelson, hero of countless sea battles, was frequently affected by seasickness, while Colonel T. E. Lawrence, the uncrowned King of Arabia, often felt the nausea of motion sensitivity while riding a camel on the shimmering desert sands.

Daniel Defoe described the motion sickness suffered by Robinson Crusoe when an earthquake shook his island, comparing the "land" symptoms with his own experience as a sailor. The hero as well as his shipmates in Dana's masterpiece, *Two Years Before the Mast*, described the horrors of *mal de mer*, which respected very few aboard ship. The same can be said of the ship captains and intrepid sailors who populate *Newton Foster* and the other novels of Captain Marryat. Even Melville's lusty brutes who pursued Moby Dick were sensitive to motion. And the heroes of Jules Verne, whether chasing the moon or crossing the oceans, could not escape their organic sensitivity.

If all human beings—even gods and heroes, mythologic, literary, and historical—are susceptible to motion sensitivity, the same is true of animals. Horses can become pitifully motion-sick, as well as seals, poultry, and even fish, as happened when fishes from the Galapagos Islands were transported to the New York aquarium and became miserably ill aboard ship.

Tobias Smollett, the great Scottish physician and novelist, described in *Roderick Random* the pitiful condition of the "miserable, distempered wretches" confined to sick bay aboard his ship. The ship's surgeons of the Spanish *galeras* of Philip II have left some dramatic descriptions of seasickness among the poor prisoners condemned to spend a lifetime rowing in galleys under the cruel whip of the *comitre*. Last but not least, one of the most unforgettable historical characters is that of the stout and indomitable soldier, who bravely faced the loss of an arm at Lepanto but rolled in anguish during seasickness—the immortal author of *Don Quijote*.

PRODROMAL AND OTHER MOTION SENSITIVITY SYMPTOMS

Motion sensitivity is almost exclusively associated in the popular mind with nausea and vomiting. This is an error. The total syndrome is divided into two very distinct stages: early sensitivity and ultimate frank sickness. Many persons never go beyond the first stage, miserable though it may be.

The first symptoms of sensitivity are usually subjective. A person in a car or aboard a ship or airplane, previously well and active, suddenly becomes quiet and subdued, acquiring what Samuel Butler facetiously called a "holy look." He loses interest in whatever he is doing, feels a sense of detachment from his surroundings, and doggedly desires to be left alone.

The next stage involves what has been termed "awareness of the epigastrium." The subject yawns frequently and evinces a sudden passion for fresh air. There may be some pallor of the skin, alternating with hot flushes. By this time mental depression is acute and the sufferer finds that loud noise and bright light are unbearably irritating. If the syndrome continues, perspiration breaks out on his forehead, the ominous "cold sweat." He experiences a subjective feeling of coldness with an

urge to shiver. Headache may appear—more frequently in men than in women. Temperature and pulse can become subnormal. Hypersalivation and frequent swallowing occur, followed by dry and furry tongue. The final stage is only too familiar, though no less unhappy,—the appearance of nausea and vomiting.

LABYRINTHINE FACTORS

The primary organic seat of motion sensitivity is in the labyrinth of the ear. This consists of a series of channels separated from the bony walls by the fluid perilymph. The membranous labyrinthine structures are filled with another fluid, the endolymph. The three semicircular canals are oriented at right angles to each other, corresponding neatly to the three planes of Euclidian space. Their function is to register changes in the rate of acceleration or deceleration and in the direction of motion.

The mechanism of sensitivity begins with the stimulation of the receptor organs in the labyrinth. Wartime research showed that a rhythmic movement in linear directions, rather than rotational movements, are the primary causes of motion sensitivity. When the labyrinthine organ is stimulated by movement, it sends impulses via the vestibular pathways to areas in the cerebellum and cerebrum. This is where the syndrome of motion sensitivity frequently ends, being confined to various disorganized impulses to the skin, the breathing center, and the cardiovascular system. Its final stage is initiated by impulses transmitted to the vomiting center in the medulla.

Repeated accelerations in different planes produce more sickness than the repetition of any one acceleration, as McIntyre[2] showed experimentally. Movements with large accelerations and short pauses are rarely nauseating, whereas small accelerations with long pauses produce nausea and vomiting more frequently. We tolerate changes in horizontal movement, even quite violent ones, but are sensitive to even the smallest vertical displacements.

NONLABYRINTHINE FACTORS

Many investigators support the theory that gross movements of the abdominal viscera are responsible for many of the symptoms of motion sickness. Keevil[3] asserts that vertical movements of a ship causes a drag on the mesentery and constrict the duodenum. A number of devices have been used to reduce the mobility of the heavy viscera, including abdominal belts, rubber air cells, and stomach binders—with debatable success.

Smell undoubtedly plays an important role in motion sensitivity, though the exact olfactory mechanism is not known. Stuffy cabins and closed cars or busses appear to stimulate the syndrome, particularly when there is an odor of oil or motor fuel. The smell of cooking and tobacco smoke are notoriously disturbing. The odor of vomit is, of course, a strong stimulant, even in persons not normally sensitive to motion sickness.

Visual stimuli are frequently implicated. A number of authors have attributed motion sensitivity to the confusion created by conflicting visual and kinesthetic

impressions, noting that sensitivity is frequently diminished when the eyes are closed. On the other hand, blind people are also sensitive to motion, and motion sickness can occur in complete darkness.

Even in instances of "make believe" travel, as when watching "Cinerama Holiday," particularly the highly realistic bobsled and jet plane sequences, hundreds of persons admitted to having developed motion sensitivity symptoms.

Schwab[4] recommends that sea passengers keep their eyes on distant objects, such as the horizon, rather than watch the rail of the ship oscillating in relation to the sea. He cites the case of a sailor who was perfectly well aboard an LST in the Pacific but who promptly became sick when he peered through binoculars to spot enemy planes. And it is a commonly observed fact that airline pilots become afflicted with motion sensitivity when they ride as passengers, largely because they no longer have the horizon to stabilize their vision.

PSYCHOLOGICAL FACTORS

A profound psychological factor enters into the syndrome at this point. As noted by Martí-Ibáñez, "The initial psychological symptom of motion sickness is disorientation with respect to our spatial position on earth. . . . Psychological disorientation creates a state of psychic discomfort followed by a sensation of uncertainty.

"The proprioceptive system sends an avalanche of alarm signals to the brain to warn it that the body is occupying an abnormal position in space. This causes a disinhibition of the mesencephalic center and results in symptoms of alarm. The victim of motion sickness, threatened by the disturbances of his equilibrium, becomes aware of a cosmic threat to the stability of his Ego. . . ."

The role of psychogenic factors in motion sensitivity has been extensively studied —and it is still being hotly debated. In a study of 115 naval personnel who suffered from chronic motion sensitivity, Schwab[5] distinguished two types: Type I presented histories of sensitivity in all kinds of moving vehicles and devices—74 per cent of them showed neurotic traits of one sort or another. In Type II, susceptible to motion sensitivity in rough weather, the incidence of neurotic traits was only 24 per cent. Rubin[6] states quite definitely that "the most important causes of airsickness, as seen in a primary air forces flying training detachment, are psychogenic in origin." Winfield thought the recurrence of airsickness under certain conditions was a "psychological escape mechanism," while Poppen[8] called it "practically always an unsatisfactory rationalization of fear." On the other hand, it was noted during the war that imminent danger frequently abolished motion sensitivity in combat personnel.

WHO IS MOTION SENSITIVE?

Innumerable tests were made during the last war to determine which individuals would be sensitive in motion on land, sea, and air. Results were thoroughly confusing. In a group of 380 navigation cadets who flew 4,534 missions, no less than 65 per cent were airsick one or more times.[9] In a flight of tough airborne troops in planes and gliders, Littauer[10] reported an incidence of 80 per cent of motion sensi-

tivity. The degree of health, nutrition or "fitness" of the subjects had no relation to their motion sensitivity.

In sea travel, Chinn[11] points out that with moderately rough seas about 30 to 50 per cent of people will become sick, while under violent conditions virtually everyone will succumb. Women are clearly more sensitive to motion during their menstrual periods. Many boastful "good sailors" become humiliatingly sick in a cross-country bus, while veteran air crews frequently collapse on board ship.

Studies now in progress may soon show that motion sensitivity is built in genetically, as is any other form of allergy. Van Egmond's group in Holland[12] has already demonstrated a clear correlation between motion sensitivity and certain structural and morphologic characteristics of the labyrinth. Using the newly developed technique of cupulometry, they were able to study the mechanism of the labyrinthine system more efficiently than was hitherto possible.

This method enables one to establish a cupulogram in the form of a graph "slope," both for sensation and for nystagmus during motion. It was found that although each cupulogram is characteristic for a given individual, it is extremely variable and changes from very steep to very flat.

In a study of personnel of the Royal Netherlands Navy, it was discovered that 80 per cent of all subjects susceptible to motion sensitivity possessed abnormally steep cupulograms. A striking feature of these graphs was that there was no essential difference between the threshold value of seasick and nonseasick persons. It was also seen that the steepness of the graph depended a great deal on the subject's general health or degree of fatigue.

PROPHYLAXIS OR THERAPY?

The strangely illogical stigma attached to motion sickness has obscured the fact that the prodromal symptoms described earlier are just as much part of the motion sensitivity syndrome as nausea and vomiting. These symptoms can sometimes be so distressing that the sufferer actually welcomes vomiting as a relief.

The new drugs now available, such as the meclizine compounds, make it possible to prevent the prodromal symptoms of motion sensitivity from developing. In the studies done by Lederer and Kidera[13] on groups of air passengers, it was demonstrated that one of the new drugs was effective in 62 per cent of subjects when the symptoms of motion sickness were already present, but that over 90 per cent were benefited when the drug was taken prophylactically.

It is also not sufficiently appreciated that large numbers of children suffer from car sickness, although it may not be serious enough to induce nausea and vomiting and for that reason frequently passes unnoticed. Infants, who are unable to explain their symptoms of malaise, are frequent sufferers during long car journeys.

THE MYTH OF SUPERIORITY

We spoke of the frequent mention of motion sensitivity in mythology, but there also seems to be a modern "mythology" connected with the syndrome. This is the tiresome concept of the "good sailor" or the "tough traveler" which lends notions

of superiority to some and inflicts a dreary sense of inferiority on others. The smug attitude of the nonsensitive traveler towards his less fortunate companions is in itself a frequent incitement to nausea.

From the factors which enter into the motion sensitivity syndrome, it should be sufficiently clear that personality has no more to do with the case than it has in common allergies. Constitutional and genetic factors affect the sensitivity or permeability of cells to certain foreign proteins, beyond the allergic subject's control. Allergies to pollen or shellfish are considered nothing shameful—why then should motion sensitivity carry with it some mysterious aura of opprobrium?

Motion sensitivity is at present an unpredictable entity, though it may one day be possible to measure a person's "motion allergy" as readily as allergic tests are done now. The new drugs have at least relegated many fantastic "old wives' remedies" to the dustbin. Gone also is the veteran seaman's admonition that the best remedy for seasickness is to "sit under an oak tree."

Man has conquered earthly space in all dimensions. Our increasing knowledge of the mechanism of the motion sensitivity syndrome and the growing efficiency of some of the newer drugs can bring man into a more pleasant relationship with his own gastric "inner space." He will certainly need all the help he can get if he insists on trying out his motion sensitivity in interplanetary travel.

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A Symposium on Health and Travel

The First International Symposium on Health and Travel, sponsored by the INTERNATIONAL RECORD OF MEDICINE AND GENERAL PRACTICE CLINICS, will be held at the Waldorf-Astoria Hotel in New York City on June 23, 1955.

Under the chairmanship of Dr. Félix Martí-Ibáñez, International Editor of this journal, it will discuss virtually every aspect of health in travel, from the care of motion-sick children to the peculiar physiologic problems of travel through outer space.

Here are some of the subjects to be presented at the meeting:

The Physician as Traveler, a historical survey by Dr. Martí-Ibáñez, tracing the intrepid voyages of physicians back to ancient Greece.

When Children Travel, by Dr. I. Newton Kugelmass, noted pediatrician, containing much practical advice on preserving children's health during a voyage.

When People Who Are Not Young Travel, by Dr. William T. Foley, describing the special problems of the aged in relation to motion and unfamiliar surroundings.

Infections and Travel, by Dr. Elmer H. Loughlin, containing among other practical points the description of a handy medicine kit for travelers.

When Sick People Travel, by Dr. Walter Alvarez, offering practical advice to persons with heart ailments, asthma, migraine, delicate stomachs and disorders of the lower extremities.

Travel and Motion Sickness, by Dr. Herman I. Chinn, a noted authority on the physiology of motion sickness as studied in the Armed Forces, with details of the most recent advances in the chemotherapy of motion sickness.

Sea Travel and Health, by Dr. William L. Wheeler, Jr., containing an account of the duties and responsibilities of a ship's surgeon during a sea voyage.

Stress and Travel, by Dr. Gaetan Jasmin, explaining the relationship between the various stresses of travel and the well-known General Adaptation Syndrome of Dr. Hans Selye.

Nutrition and Travel, by Col. Miriam Perry of the USAF Women's Medical Specialist Corps, giving an account of wise diets for fliers.

Geography, Travel and Disease, by Dr. Jacques M. May of the American Geographical Society, explaining the problem of immunity and nonimmunity in various regions of the world.

The Medical Problems of Space Flight, by Dr. Hubertus Strughold, a practical guide to the problems that will face man in outer space flight.

Sponsorship of the Symposium on Health and Travel by this journal is an extension of its policy to present symposia on the most pressing problems in medicine.

Treatment of Bacterial Infections with Sulfoglycin

Werner Anders and Walter Stephan

THE STÄDTISCHES KRANKENHAUS, BERLIN-TEGEL-SÜD, GERMANY

Sulfoglycin is a sulfonamide in which sulfanilic acid is linked with a glycine derivative of sulfanilglycine-diethylamide. The white crystals are easily soluble in water, acid or alkaline media. The solution in water has a *p*H of 6.8 and rapidly reaches a high concentration in the blood. It has been studied in the treatment of postoperative urinary infections, cystitis, and prostatitis. Rogmans* reported on its efficacy in infectious ophthalmitis and the present authors studied its action in Kruse-Sonne dysentery. This report deals with clinical trials in lobar pneumonia, bronchopneumonia, cystopyelitis, tonsillitis, and erysipelas.

Lobar pneumonia. Five patients (4 females, 1 male), were treated; 2 were nearly 50 years old and one patient was nearly 70. Sulfoglycin was administered to one patient orally and intravenously. A female patient who entered the hospital with cardiac decompensation received the drug intravenously; this was well tolerated but the patient died of the heart disease. The other patients received a daily dose of between 0.09 and 0.15 Gm. per Kg. of body weight for four to six days, providing a total dose of approximately 40 Gm. One young female patient was given a total dose of 26 Gm. of the drug. In none of the patients was any toxicity observed. Temperatures fell to normal within 48 to 96 hours; a week later the clinical and roentgenologic symptoms had disappeared. No relapses or complications were observed.

Bronchopneumonia. Eleven female patients were treated, their ages ranging from 17 to almost 90 years. Three patients died of heart diseases after responding well to sulfoglycin. One patient received sulfoglycin in combination with penicillin. The daily dosage varied between 0.07 and 0.12 Gm. per Kg. of body weight, with an average total dose of 40 Gm. within four to five days. Temperatures dropped to normal within four to five days; there were no relapses or complications. Three of the patients received sulfoglycin in combination with strophanthin.

Cystopyelitis. Seven female patients, between 53 and 81 years of age, were treated with a daily dose of between 0.01 and 0.1 Gm. per Kg. of body weight, the total dosage varying between 20 and 74 Gm. over a period of two to nine days. In 4 cases administration was by the oral route combined with intravenous injection; the other 3 patients received the drug orally. In one case, oxytetracycline was added to the therapy. Temperatures became normal and clinical symptoms regressed within four to 15 days, depending on the severity of the disease.

Miscellaneous. Three female patients with lacunar tonsillitis (one with beginning abscess) were treated with the same dosage as the dosage used in cystopyelitis. All

* ROGMANS, G.: Ärztliche Praxis, 5 (38) 1953.

3 recovered in three to six days, and the drug was well tolerated. Two female patients nearly 80 years old were treated for erysipelas. The first patient, a diabetic, had developed the erysipelas in the vicinity of an ulcer on the leg, involving the lower and middle third of the extremity. Daily administration of 8 Gm. of sulfoglycin for six days caused the disappearance of subjective and objective symptoms. The second patient with cardiac decompensation and severe edema of the legs had developed erysipelas bilaterally from the heel to the knee. Administration of sulfoglycin in a daily dosage of 6 Gm., partly orally and partly intravenously, caused afebrility on the second day, and disappearance of the erysipelas by the third day. There were no relapses.

SUMMARY

Sulfoglycin was used in the treatment of lobar pneumonia, bronchopneumonia, cystopyelitis, tonsillitis, and erysipelas. The drug was administered in dosages varying between 0.01 and 0.15 Gm. per Kg. of body weight. In some cases, sulfoglycin was combined with strophanthin, penicillin or oxytetracycline. The drug was effective in the conditions treated and there were no toxic manifestations.

EDITORIAL SURVEY

A Unified Field of Life

Until the last day of his life, Albert Einstein worked on his unified field theory, an attempt to combine light, magnetism, radiation, and gravitation in one "continuum" comprising mass, energy, space, and time. Can this stupendous concept, as well as his earlier theory of relativity, be related to the living organisms with which we are familiar in the laboratory and the clinic?

When we examine our own concepts of physiology in the light of Einsteinian principles, it is disconcerting to discover how far medicine lags behind physics. In many respects we are still living in a Newtonian world of separate and distinct entities such as space, time, matter, and energy. We think largely in terms of "forces," such as biochemical energy and psychic impulse, endogenous and exogenous influences, and other survivals of an animistic past.

Consider a patient in whom we observe a syndrome of irritability, nervousness, and mental depression. We have learned in recent years that these symptoms may indicate either an altered acid-base balance in the body fluids, a lack of nicotinic acid, a subconscious psychologic conflict, or cumulative environmental stress. Each of these "causes" constitutes a specific system in space, separated by a "time lag" between so-called cause and effect.

If we apply the space-time dimensional theory of Einstein to this problem, we could conceive of the syndrome as being part of a "continuum of imbalance" in which there are neither causes nor effects, neither intervals in space nor in time. With such a notion firmly fixed in our minds we would be less concerned with specific therapy and more inclined to treat the whole patient, both in his internal and external environments.

Another intriguing application of the space-time relativity principle is in Lecomte de Noüy's theory that our mental concept of the duration of time is relative to the rate of growth of our body cells, in inverse proportion. A week seems an eternity to a child, it seems to flash by faster and faster as we grow older. Time thus becomes an integral dimension in our total cellular-psychologic equilibrium.

BIOLOGIC "FISSION"

It is a curious fact that most biologists and physicians tend to think of cells and molecules as the basic elements of life. We know something of the staggering complexity of chemical transformations that take place inside cell protoplasm, and we have at least a nodding acquaintance with the baffling behavior of chromosomes and genes in the cell nucleus. In recent years, we have begun to pry into the work of enzymes and vitamins in building amino acids into protein molecules, the physical stuff of life.

But what is a protein molecule? It is an elaborate pattern of atoms of carbon, hydrogen, oxygen, and nitrogen. The water which constitutes 85 per cent of cell protoplasm is the familiar marriage of two atoms of hydrogen to one atom of carbon. And every one of these atoms is the same miniature universe of protons, neutrons, and electrons as the one uncovered by atomic fission.

The smallest alteration in the pattern of this subatomic universe can produce startling changes in the behavior of a biologic substance. For example, linoleic acid is an essential fatty acid required in our diet and we cannot replace it with its close relative—oleic acid. Yet the difference between the two substances is merely the deficiency of two protons and two electrons in the linoleic acid. It is here that we enter the unfamiliar realm where biology becomes a matter of applied physics. Einstein's famous formula of $E = mc^2$ applies equally to our little finger as it does to a lump of uranium.

Einstein demonstrated that an atom is a continuum of matter, energy, and velocity. It was left to his disciples to show that this "predictable turmoil" obeys certain general laws of wave mechanics, i.e., frequency, amplitude, harmony, and dissonance. Prince de Broglie's historic addendum to Einstein's work was the concept of matter as being both particle and wave—two aspects of the same reality.

WAVES OF LIFE

If atoms obey certain laws of vibration and our biologic organism is composed of atoms, is it possible that life processes are part of a universal pattern of vibrations?

We know that there are many puzzling phenomena in physiology. Why do we observe a subjective difference between certain colors, classifying red as "exciting" and green as "tranquil"? Why does a minor chord in music suggest a melancholy mood while a major one produces more buoyant feelings? How does the hypothalamus, for example, distinguish between what we call a pleasant and an unpleasant sensation?

Is it possible that the atomic structure of the retina cells possesses a certain inherent vibrational field, as do possibly the cell-atoms of the visual area of the brain? If that were so, then light vibrations received from outside could be harmonics, in which case the cell-atom vibrations would be reinforced, or they could be inharmonic in which case they would cause interference or dampening patterns. Could the same wave mechanism also apply to sound patterns translated into electronic impulses in the auditory apparatus and the auditory area of the brain?

As to more generalized sensations, might it not be that all the subatomic fields of our body cells have been adjusted to a certain vibrational field required to maintain homeostasis, and that any vibration that is dissonant is rejected as inimical to the organism?

We know that our environment is one vast electronic field in which quanta of particle-waves are in constant flux. We have the normal or abnormal ionization of the atmosphere, the radioactive content of radon gas in the air we breathe, the cosmic ray particle-waves that constantly shower on us from outer space. Neither can we forget the gravitational forces of the moon and possibly of other planets, and

the periodic alterations in the energy from the sun. All these are vibrational in nature, and it is inconceivable that they do not exercise some influence on the inner electronic fields of our body cells.

Where does such speculation lead us? Our only excuse for indulging in it is that were it once shown that we humans are basically electromagnetic fields, we could apply for admittance into Einstein's unified field and become an integral part of his universal continuum.

Would that be of any immediate benefit to physicians and their patients? Perhaps not, but our human intellect is so constituted that it cannot be satisfied with a mere accumulation of facts—as we are now doing in medicine and biochemistry—it thirsts to discover mechanisms or systems to account for the observed phenomena.

Einstein himself, although unversed in medical science, was intensely curious about the relation between living organisms and his vast universe of physics. More than once he asked, "What is the meaning of human life or, for that matter, of the life of any creature?"

His death has robbed physics of one of its greatest intellects. But we would predict that the philosophic impact of his theories will extend in ever-growing circles until it engulfs and unifies all sciences and all existence. As Einstein once wrote: "The supreme task of the physicist is to arrive at those universal elementary laws from which the cosmos can be built up by pure deduction. There is no logical path to these laws; only intuition, resting on sympathetic understanding of experience, can reach them."

SYMPOSIUM ON MEDICAL HISTORY

What Medicine Has Contributed to the Progress of Civilization*

Henry E. Sigerist, M.D., D. Litt., L.L.D., D.Sc., F.R.C.P.

PURA, SWITZERLAND

Before discussing the problem of what medicine has contributed to the progress of civilization, we must raise the questions: has civilization progressed at all? Are we more civilized than the Athenians in the fifth century B.C., or the Romans of the Augustan Age, or our medieval ancestors of the thirteenth century, or the men of the Renaissance? Has there been progress in poetry, music, the fine arts, in human intercourse, which are the essence of civilization? Is there more love in the Christian countries today than there was in the early Christian communities, more compassion in Buddhist countries at this time than at the time of Asoka?

It is impossible to answer these questions with a clear yes or no because the concept of progress does not apply to some of the finest manifestations of the human mind. We have great poets, composers, and painters but nobody would claim that there has been progress from Petrarch to Paul Valéry, from Bach to Bartok, from Raphael to Rouault. Each one of these great men expressed in a perfect way the aspirations of his time with the means available at that time. And after two world wars and colonial wars fought with increasing savagery and with the most despicable means, we have no reason to be proud of our civilization.

Voltaire fought a lifelong battle for the abolition of torture as a method of legal procedure, but today torture is used again in many countries. We tried to humanize war through the Red Cross but civilian populations of entire cities continue to be wiped out. I need mention only Guernica, Lidice, and Hiroshima to remind you of some of the darkest spots of our present civilization.

Yet in spite of these reversals to primitive savagery some progress has been achieved. Greek civilization of the fifth century B.C. was shared by a small upper class only, the same group that enjoyed the benefits of Hippocratic medicine, for it was not a *medicina pauperum*. Poor people either had no medical care or had to seek

* An address delivered at the XIVth International Congress of the History of Medicine at Rome, Italy, on September 17th, 1954.

it in the temples, and even there gifts were expected. The Rome of Augustus and his successors produced great statesmen, writers, and poets, but here again it was a relatively small upper class which prospered from the labor of innumerable slaves at home and in the colonies. The very fact that there was such an immense proletariat in the Roman Empire created a most fertile ground for the acceptance and spread of Christianity, a religion that addressed itself not only to the pure but also to the underdog and promised healing, redemption, and equality before God. The medieval world was the picture of a perfectly integrated society which had great spiritual and artistic values, but the insecurity in which the individuals lived was very great. War, famine, and pestilence were constant threats to which millions of people succumbed. Conditions were not much better in the Renaissance, nor was life very safe in the seventeenth and eighteenth centuries.

When we look at today's world we must distinguish between economically advanced and economically undeveloped countries. In large sections of the globe and particularly in Asia, Africa, and parts of Central and South America millions of people still live in dire misery—poor, ignorant, sick, always undernourished, working as coolies or peons, the modern version of slavery. But today in all these countries there is a tremendous awakening. Century-old chains are being broken; land is being redistributed so that those who till it may have their due share. The colonial period is coming to an end, and people of all colors and races are refusing to be exploited for the benefit of a foreign master.

Though colonialism may still mean foreign domination by force of arms, it may also appear camouflaged in the more subtle form of economic imperialism when a foreign power owns and exploits the riches of a country's soil, determines the wage level, and thus the standard of living. However, in whatever form it may appear today, colonialism is doomed. People of all lands want to be free—free to determine their own destinies. Countries like India and China are each experiencing in its own way, changing economic conditions, or rather a new economic order, liberation from age-old religious customs, and other taboos, and concomitantly a new flowering of culture, much as we of the West did in the Renaissance. The time may possibly not be so far distant when countries of Asia, Africa, Central and South America shall have reached a material standard of living comparable to that of Western Europe and the United States, and perhaps on an even higher cultural level.

This brings me now to the discussion of the so-called economically advanced countries of the West and here there can be no doubt that civilization has progressed in a certain sense. Poetry, music, and the fine arts may not be better than in the past but the number of people who have a share in them is infinitely greater. Workers are no longer slaves or serfs, coolies or peons, but free men who work under contract and have strong unions to protect them. The production of goods and commodities of all kinds has increased considerably and the number of people who enjoy them is greater than ever before. Life, in normal times, is very much safer than in the past, and all this undoubtedly means that on this account civilization has progressed. The question now is to determine what medicine has contributed to this progress.

We all know that a sick artist or writer may create great works. Mozart was

suffering from tuberculosis when he wrote his *Requiem* as was Fragonard when he painted some of his loveliest pictures. Van Gogh undoubtedly suffered from a serious psychosis, and Paul Verlaine wrote some of his best poems when he was intoxicated with alcohol. Illness, in other words, does not prevent some people from creating great works of art, the illness becomes part of their personality and expresses itself in their work. But these are exceptions. Men like Monet, Cézanne, Matisse, Picasso, Emile Zola, Thomas Mann, and many others would never have created what they did if they had been handicapped by illness. Good health for the people, of the creative artist as well as of the laborer and farmer, is a prerequisite of a higher civilization and there can be no doubt that in this respect conditions have tremendously improved in the West.

A child born in the eighteenth century had very good chances of dying soon after birth or as soon as the summer heat set in and infantile diarrheas developed and caused havoc among the newborn. A few years later such infantile diseases as measles, whooping cough, scarlet fever, diphtheria, and many others threatened the child's life. When he reached adolescence tuberculosis was a disease which frequently destroyed many young lives. Smallpox was a dreaded killer in the old as well as in the new world and it has been estimated that in the eighteenth century, despite inoculation, 2,000 people died annually of smallpox in London alone. Water and food carried diseases such as typhoid fever and dysentery, which not only caused epidemics but were endemic in many countries. Cholera reached the West three times during the nineteenth century. Malaria, a tropical disease, was widespread, reaching far north, in Europe as well as America.

All this has changed, and in the economically developed countries health conditions are better than they have ever been. This enormous progress can be measured and, therefore, expressed in figures. The general death rate of London, that is the number of annual deaths per 1,000 population was on an average 42 during the period 1681 to 1690. It dropped to 23 in 1846 to 1855 and was 14.2 in 1929. Today it is between 8 and 15 in advanced countries. Similarly the infantile death rate, that is the number of infants dying during the first year of life, for every 1,000 children born is today between 25 and 70 in most advanced countries. It was 17, that is 1.7 per cent in the Swiss city of Basel in 1951. In the eighteenth century the infantile death rate was 10 times higher all over Europe. Many children were born and many died. As a result of improved conditions the average life expectancy at birth has increased in a spectacular way. It has been estimated that it was 20 to 25 years in the fifteenth century; it is between 60 and 70 years today in the West.

There had been a spectacular decrease in the mortality of certain diseases. The following comparison for England and Wales may illustrate this. The number of deaths per one million population was:

	1871–1880	1931–1940
Smallpox	240	0
Typhoid	320	5
Typhus	60	0
Tuberculosis, respiratory	2,130	601
Tuberculosis, other forms	750	121

Another set of impressive figures comes from the U. S. Army. For every six men who died, not from battle wounds but from disease during World War II,

160 died during World War I

250 died during the Spanish-American War of 1890

650 died in the Union Army during the Civil War of 1861 to 1865.

This is a drop from 100 to 1 in less than a century. These few figures illustrate most graphically the progress of medicine and one great contribution it has made to civilization. Of course, we must be aware that medicine was not the only factor responsible for these advances. The higher standard of living, more and better food, housing, clothing, heating, etc., were probably even more instrumental in improving conditions. This is best illustrated by a statistic published by Winslow. On one fifth of the inhabited earth the people have on an average:

Annual income	$461.00
Food consumed per day	3,040 calories
Physicians available per 100,000 Population	106
Life expectancy	63 years

On four-fifths of the inhabited earth, however, the people have only:

Annual income	$41.00
Food consumed per day	2,150 calories
Physicians available per 100,000 Population	17
Life expectancy	30 years

This shows that the task is by no means completed. Large sections of the globe still live on a very low standard and do not enjoy the full benefits of modern medicine. But even in the advanced countries much remains to be done. The acute diseases are no longer the main killers; the chronic diseases are in the foreground. In the United States, a country with very good health conditions, 26,000,000 people suffer and are handicapped by chronic illness, rheumatic diseases, diseases of the heart and circulation, asthma, hayfever, chronic bronchitis, kidney diseases, psychoses and neuroses, diabetes, tuberculosis, and gastric and duodenal ulcers. There are still great unconquered enemies, such as poliomyelitis and cancer. But there can be no doubt that enormous progress has been achieved. Life, in many countries, has become infinitely safer and the span of life extended considerably. This has created still a new unsolved problem, for there is no point in having a large overaged population of senile and decrepit individuals. Medicine still has to find ways and means to keep the tissues, particularly the connective tissue, young and elastic.

What has made medicine so infinitely more efficient than in the past? It was science, the fact that medicine became scientific. I think it is no exaggeration to say that until the time of the Renaissance, European, Arabic, Indian, and Chinese medicine were equally effective when it came to treating sick people. They all had a wealth of practical experience available, knowledge of drugs, of physical treatments and operations, and also of mental treatments, which were effective. They all had, in the course of time, elaborated theories which explained to a certain extent the phenomena of health and disease and were not so very different from one another. Arabic and European theories were almost identical as both were based on Greek medicine. Indian medical theory was not very different either, and even Chinese

medicine held views which, although not the same as those of the other countries, yet were related in their philosophical approach. All these medical theories were essentially philosophical, drawing heavily from the physician's practical experience. It is safe to say that until the time of the fifteenth century world medicine in most parts of the globe had reached about the same degree of effectiveness and was theorizing along similar lines of thought.

This changed during the fifteenth and sixteenth centuries when European medicine began to take a turn toward science which was to give it supremacy for several centuries and was to make Europe the center of medical progress.

What was responsible for this changed attitude? I think it was the great experience of the Renaissance, an experience that neither the Arabs, the Indians, nor the Chinese had at that time. A new economic order developed which appealed to the individual in man, called for free initiative, and opposed the traditional authorities. The world was discovered, the universe, new continents, the human body, new animals, and plants. There was a strong trend to realism, a turn to science. H. M. Pachter, in a fascinating book on Paracelsus, has very correctly pointed to the striking parallels between the Renaissance and our own time. There, too, imperialisms clashed, those of Spain and France; hot and cold ideological wars were fought over the Reformation, great social upheavals took place with the peasant wars, and the new science was as confusing then as atomic science is to us today.

From that time on science and medicine were more and more closely linked together. Every physical, chemical, and biologic discovery had repercussions in medicine sooner or later and contributed to its progress. And who made these discoveries? Physicians, in very many cases. The fathers of botany who made new inventories of the vegetable kingdom—the Fuchs, Brunfels, and others were doctors who became botanists while investigating drugs. The man, who for the first time since Aristotle made a comprehensive repertory of the animal world, Conrad Gessner, was municipal physician in Zürich. J. J. Scheuchzer, one of the early paleontologists and a general naturalist, was a physician as were Vesalius, Copernicus, Harvey, and most of the first members of the early academies. The practice of medicine was a means to earn a living and from the circle of their experience, in an endeavor to understand man in health and disease and the world at large, they became mathematicians like Leonhard Euler and the Bernoullis, physicists like William Gilbert, chemists like Hoffman and Stahl, and of course biologists. These physicians not only made important contributions to science but developed the methods of scientific research and above all the experimental method among whose pioneers were William Harvey and Santorio. Science is one of the most brilliant aspects of civilization, one that has truly progressed, and medicine has contributed to this progress for many centuries.

I should like to mention the relation between philosophy and medicine. I do not know if philosophy has "progressed" since the days of Plato and Aristotle, but there certainly has been a development. We said before that the ancient medical theories were largely philosophical. Physicians felt the need to interpret the phenomena of normal and pathologic life. They had to have a theory to connect and correlate the infinity of empirically gained facts. They searched for theories that would guide

them in their actions, and conceived them philosophically in the categories of thought available at their time. I need not emphasize that there would have been no Hippocratic medicine without the work of the pre-Socratic philosophers and particularly of the Pythagoreans and of Empedocles. The concept of harmony or symmetry was the basis of all medical theories. Health appeared as a condition of perfect equilibrium and disease developed when the balance was upset. This is as true today as it was then. A status of equilibrium presupposes a material substratum as it cannot exist in a vacuum. Explanations changed in the course of time and it was assumed that the carriers of the balance were forces, humors, atoms, the elements of Indian or Chinese medicine, or the three principles of Paracelsus, set in motion, made alive by the innate heat, by Brahman, ying and yang, or the Paracelsian archeus. We operate with concepts of chemistry and physics and are perhaps somewhat less speculative and closer to the truth, but our theory of life in health and disease is by no means purely scientific; it still has many speculative elements.

Every philosophy, be it that of Plato, Aristotle, the Stoics, Epicureans, Skeptics, Christian philosophy, Vitalism or Materialism, to mention only a few Western philosophies, is reflected in medicine, and to all of them physicians made contributions. Their knowledge of man and human suffering, their study of life in health and disease, could not but stir some of them and drive them to reflect about the final causes of life.

Along this line the greatest and most far-reaching contribution of medicine has been in the field of psychology. The first impulse probably came from physiology. Wilhelm Wundt and his school demonstrated that many mental processes could be measured with apparatuses which are still used today for capacity and other tests. The Russian neurophysiologic school of Sechenov, Bekhterev, and above all Pavlov, exerted and is still exerting a tremendous influence on philosophy, psychology, sociology, and the conduct of human affairs in general. Pavlov's theory of conditioned reflexes opened up wide horizons far beyond the field of physiology.

Further impulses came from psychiatry. Charcot's clinic in Paris was attended not only by physicians and medical students but by philosophers, writers, artists, and people from all walks of life. His case histories as well as the case histories from the Hôtel-Dieu of A. Trousseau were eagerly read and served as examples to the young naturalistic school of writers. The brothers' Goncourt's novel *Germinie Lacerteux* of 1865 and Emile Zola's first novel *Thérèse Raquin* of 1867 are plain clinical case histories. Zola's gigantic fresco of French society at the end of the Second Empire, the *Rougon-Macquart*, is a detached study in heredity, which pictures the ups and downs of human life in all its aspects and in a most realistic, almost clinical, way. The whole school was deeply influenced by Claude Bernard who in his *Introduction à la médecine expérimentale* of 1865 enthroned Reason and described the methods by which science interrogated nature and forced her to answer questions. Zola, inspired by Bernard's book, wrote *Le Roman expérimental* in 1880, which became the bible of the naturalist school. But long before, in 1859, Victor Hugo, that great poet and radical politician, in *La Légende des siècles* had said that the mission of the poet and philosopher was to try to handle social facts as the naturalist does zoologic facts.

Thus medicine has undoubtedly exerted a strong influence on literature and this was not only the case in the nineteenth century. There was a time when medical literature was not only conveying observations and ideas but was real literature as well. Fracastoro's poem of 1530 on syphilis is not only a medical book but an epic, the beauty of which enchanted his contemporaries as it still does us today.

Psychiatry had far-reaching repercussions in many fields of human civilization. The work of men like Forel, Bleuler, Kraepelin, Freud, Adler, Jung, to mention only a few, greatly enriched our knowledge of the workings of the mind. This deeper understanding of man's mental reactions made it possible to improve education greatly and to develop a mental hygiene by which people may be kept adjusted to their environment and may be prevented from becoming asocial. Mental hygiene is still in its infancy, that is, we have the knowledge to keep people adjusted as happy and useful members of society and to prevent crime to a large extent, but it takes much time for the authorities to take advantage of scientific progress unless it be for purposes of war, when unlimited funds are immediately available.

The new psychiatry is also beginning to exert a deep influence on the administration of justice. For centuries the physician was the scientific adviser to the court. He had to determine the cause of death and the circumstances under which it occurred. His was the whole wide field of forensic medicine which has a long history and which was frequently connected academically with public health. Today the physician is becoming in an increasing measure also the psychological adviser to the court. If an individual has become asocial and has committed an offence, we no longer wish to take vengeance on him or to punish him. We want to know why he became asocial and to reintegrate him into society as a useful and happy member of it. To that end we need a painstaking case history which will take all physical, mental, and social factors into consideration. The court needs the advice of the psychiatrist more than ever before for taking the case history and also for determining the cure. In this particular field, medicine has greatly contributed or rather is beginning to contribute in an increasing measure to the progress of civilization.

This leads us into the field of sociology from which medicine has received much information but to which it is contributing more and more as it develops into a social science. Looking into the future we must admit that healing will no longer be the main task of the physician although still a very important one. Medicine must by necessity become preventive medicine. There is no point in letting people break down and suffer from preventable diseases. There are enough sources of suffering in the world that may not be prevented so easily. The major tasks of medicine will be the maintenance and promotion of health, the prevention of disease, healing when prevention has broken down, and finally the social rehabilitation or reintegration of the former patient into society. The doctor's place will no longer be in his office where he would sit waiting for patients; it will be in the factory, the mine, the farm, the ship, wherever people convene for work. His headquarters will be the Health Center. Such a program obviously requires the close cooperation of the physician with educators, physical culturists, social workers, administrators, and statesmen. The relation between medicine and sociology will be a very close one.

History, the picture we carry in us of our past and one which largely determines

our actions, is undoubtedly an important aspect of civilization and I think that in our own field, the history of medicine has given us a fuller and more correct picture of the past. The time is not so far past when history was merely political history, the story of dynastic quarrels, of wars and treatises of peace. It was a great step forward when historians became interested in economic and social history. For a long time they still disregarded the impact of science on the development of civilization, or at least did not pay sufficient attention to it. It is impossible to write economic history without considering technological changes but science as the driving force of technology was not sufficiently acknowledged. This has changed today. Nobody could write the history of the seventeenth century and be taken seriously unless he mentioned Newton. Our contribution has been to point out the significance of health and disease in a given society, to show for instance what the prevalence of malaria or hookworm meant to the population of a country at a given time. Medical history has shown that medical literature is literature and that we should have a very incomplete picture of the civilization of Greece in the fifth century B. C. if we disregarded the Hippocratic writings. We have shown what a profound influence was exerted on the society of the period by the great epidemics of the Middle Ages—leprosy, plague, dancing mania, flagellantism, ergotism, and so many others, and in the Renaissance, syphilis. We should have a very one-sided notion of Leonardo da Vinci if we studied him as an artist only and disregarded his anatomical and other scientific works. The impact of the Industrial Revolution on economic and social life is well known, but medical history was able to point out how it affected the people's health and what new medical problems it created. We were also able to demonstrate that medical books, journals, reports, and case histories are sometimes extremely valuable sources for the social history of a region. The physician who treated slaves on a plantation had no ax to grind. He simply made note of what he saw and did. Thus the history of medicine has undoubtedly contributed to a deeper understanding of historical development.

Finally, I would like to mention that many physicians have made important contributions outside their own medical field. A French physician, Théophraste Renaudot, in 1630, founded a labor exchange office, and in 1631 the first newspaper, the *Gazette de France*. Guy Patin became famous not for his medical work but for his sarcastic *Lettres* published after his death and reprinted repeatedly. Some of our best contemporary novelists, men like Duhamel, Luc Durtain, Gottfried Benn, are physicians and their medical experience, physical and psychological, is reflected in their work. Many physicians were social reformers. Auguste Forel took up the fight against alcoholism and the drinking habits that stultify entire social groups, at a time when such a fight was unpopular and required much courage. With the same enthusiasm he fought against sexual taboos and for a normal healthy sex life. He gave peace of mind to many young people who were afraid of the imaginary consequences of masturbation that the windbag S. A. Tissot had pictured in the eighteenth century in a book which unfortunately is still reprinted today and sold under the counter.

I wish to remind you that the great pathologist Rudolf Virchow was throughout his life, but particularly in his younger years, a very active social reformer and

statesman. He took part in the revolutionary movement of 1848, and, although his journal *Die Medizinische Reform* was short-lived, it nevertheless paved the way for important medical reforms that were carried out a few decades later. It was Virchow who coined the sentence, "The physicians are the natural attorneys of the poor, and social problems fall to a large extent within their jurisdiction." They should know social conditions best as their profession takes them into the homes of all social classes, and it is their duty to work for the improvement of conditions. It is the duty of all of us as we practice not only psychosomatic but also social medicine and as we are citizens of democratic countries who have a great responsibility toward the community.

The World Health Organization in the preamble to its Constitution defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." It postulated furthermore that "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition." And the acceptance of these principles by all member nations is a very great contribution of medicine to the progress of civilization.

Ancient and Primitive Drugs

Douglas Guthrie, M.D., F.R.C.S.[*]

UNIVERSITY OF EDINBURGH
EDINBURGH, SCOTLAND

One is often asked whether modern medicine has already fully exploited the innumerable remedies that were in vogue in ancient times and also the drugs that are still used by primitive peoples in many parts of the world. Can we derive therapeutic hints and assistance from these two sources, or has medical science already adopted all that was worth while, leaving the remainder to be cast aside as useless or, at best, to be regarded as mere historic landmarks? Yes, we must admit that those mines are worked out for the most part and that we can hope for no noteworthy addition to our materia medica, derived from ancient herbals or from the primitive medicine in use today.

Nevertheless it is worth while to take count of the obsolete drugs of the past and the primitive remedies of the present which, after all, have formed the basis of modern treatment.

THE MEDICINES OF PRIMITIVE MAN

In this short paper we shall confine our attention to medicinal remedies, commonly called drugs, although that word is now often used in the restricted sense to designate a narcotic or a poison rather than a remedy. In the medical practice of primitive man, drugs play but a small part. Magic and supernatural methods are, in his view, much more potent. Such drugs as he uses are mainly those of vegetable origin. The lower plants are seldom used, i.e., the fungi, mosses, and ferns. It is from the highly differentiated plants that most remedies are derived. The roots and leaves are the parts most often used, at least in Africa, the country with which the writer is familiar. The juices, wood, stems, and seeds are less frequently employed. Sometimes the leaf or root is eaten raw, but more often it is prepared as a liquid decoction or infusion. The dosage is varied and uncertain. Pharmacologists who have made a special study of those drugs affirm that the great majority are inert.

The native names of the plants are often an inaccurate guide, and one name may be applied to several plants of different species. The therapeutic value of a plant remedy may vary according to the season in which it is gathered, a fact not always remembered. Thus, an accurate investigation of the so-called native remedies is beset by many difficulties. Many of the preparations are purgatives of rather drastic action.

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[*] Lecturer in History of Medicine, University of Edinburgh.

Numerous are the tales of marvelous cures wrought by native practitioners, and the veracity of those who tell them must often be credited. Nevertheless it seems doubtful whether any further spectacular discovery may be expected from this line of research, although it does seem a pity that so few expert pharmacologists have been inclined to pursue it. Of course it is not surprising that a system of medical treatment based not only on empiricism but also, and to a greater extent, upon magic and witchcraft will defy investigation by the coldly material method of modern science. The differing reaction of each individual to the same drug, the idiosyncracy, as it used to be called, is a factor that may defy analysis. Furthermore, native medicine is more psychic than physical.

MAN'S DISCOVERY OF REMEDIES

The introduction of chemotherapy, Ehrlich's method of using a magic bullet that would always hit the mark, has altered our entire therapeutic outlook. No longer are we forced to depend upon the trial and error method of testing the effect of fruits or berries or other vegetable products, in order to determine whether they are foods or poisons or whether they have some specific effect upon the human body in health or in disease. That was the only method known to our primitive ancestors and also to primitive man as he exists today. The method of pure observation and sheer empiricism soon became mixed with various forms of magic and ritual, and the reasons for the choice of remedies were often very strange. In medieval times, and perhaps even earlier, there arose the curious doctrine of "signatures." For every disease, it was argued, there must be a definite remedy, if only it could be found.

The idea of signatures was that of curing a bite by taking a hair of the dog that bit you. For example, the leaves of *Cyclamen* were shaped like the human ear and were therefore to be used for ear diseases, while the spotted leaves of the plant called "*Pulmonaria*," which in appearance resembled the lungs, were a specific for chest affections. Saffron, on account of its yellow color, was advised for jaundice. It was a strange system of treatment, but at least it was better than the blind gropings of earlier seekers after cures. As time went on, the search became more purposeful, although treatment remained empiric because of the lack of knowledge of the causes of disease. We still use many drugs without knowing exactly how they act, despite the amazing advances of recent years along the lines visualized by Ehrlich.

After the downfall of Greek and Roman power, Arabian physicians made noteworthy advances in materia medica and in chemistry, although for the most part they allowed themselves to be guided by astrology or more often by mere chance.

The discovery of America was followed by the introduction of all manner of new drugs into Europe, and the "herbals," or books in which they were described, grew larger and more complicated than ever. Samuel Hahnemann's system of homeopathy helped to check the vogue for lengthy prescriptions containing large and even dangerous doses. That was during the nineteenth century, a century during which there also appeared a wave of "therapeutic nihilism," when physicians were more interested in postmortem findings than in the recovery of patients. Once again the

pendulum has swung toward carefully planned therapy, and in the antibiotics and other tools of precision we have weapons against disease that would amaze our forefathers.

UNICORN AND MUMMY AS SOURCES OF DRUGS

As a complete contrast to the present situation, it is interesting to recall some of the remedies that had a high reputation in the days of old.

Consider, for example, the story of the unicorn, a very strange tale indeed. The mythical unicorn, it was said, could be captured by a virgin in whose lap the animal innocently laid its head, while the hunters rushed up and slew it. As every child knows, the unicorn was the traditional enemy of the lion, and it has been identified variously with the rhinoceros, the oryx, and the narwhal. The oryx antelope, to be sure, has two horns, but they are not clearly separate when viewed at a distance, and sometimes one is missing: hence the myth of the unicorn. It is more easy to note how the rhinoceros was called the unicorn. Rhinoceros horn, made into a cup, was regarded as an infallible protection against poison, and the powdered horn is still highly esteemed in native medicine. The relationship of the unicorn to a marine creature, the narwhal, is not so easy to understand. Nevertheless the horn of the unicorn, as it was displayed in churches and in museums, was certainly the single tusk or horn of the narwhal.

Jerome Cardan, on his way from Milan to attend the Archbishop of Scotland in 1552, spoke of seeing in the Church of St. Denis at Paris "the rare and perfect horn of a unicorn." One of the chief contributions to the literature on the subject was *De Unicornu*, by Thomas Bartholin, Professor of Anatomy in Copenhagen (1616–80), a strange work dealing with every variety of horned creature, real or imaginary. Unicorn was a medieval remedy for numerous ills. One of the first to demonstrate its uselessness was Ambroise Paré, when he wrote, in 1582, his *Discours de la Mumie et de la Licorne*.

Mummy was a remedy even more ancient than unicorn. Originally it was a product of Egyptian mummies, but, if that source was not available, any dried corpse might be used. The mummy of commerce, for use as a drug, was a resinous substance that sold at an enormous price. Paré stated that its source was always doubtful, and, like unicorn, it was quite inert. Nevertheless each of those curious drugs had a great vogue, and even such distinguished men as Lord Bacon and Robert Boyle extolled the virtues of mummy as a wound dressing, which may have been quite justifiable, as the embalming resins doubtless had some antiseptic value.

Sir Thomas Browne, in his work, *Urn Burial*, published in 1658, tells us that "Mummy is become merchandise, Mezriam cures wounds and Pharaoh is sold for balsams," which suggests that even in his day it was not entirely discarded.

BEZOAR STONE AND VIPER'S FLESH

Antidotes against poisoning were in great demand during the middle ages. One of the best known of those antidotes was bezoar stone, the concretion or enterolith

sometimes found in the intestines of goats and other animals. Bezoar stone was highly prized, not only as an antidote to all manner of poisons but also, according to Pomet's *History of Drugs* (1712), as a remedy for vertigo, jaundice, dysentery, and colic. The dose was 6 grains of the powdered stone, but even the carrying of the stone as a charm or amulet was believed to render the bearer immune to poison.

Still more strange was the use of the flesh of vipers as an antidote to poison. This was the principal ingredient in the substance known as theriaca or Venice treacle,

FIG. 1. Medieval illustrations of the plant Mandragora: (left) from Herbal of Apuleius; (right) from thirteenth century manuscript in the British Museum.

the name treacle being at one time applied to any thick fluid. Theriaca contained, besides vipers' flesh, coral, pearls, and many other ingredients. Indeed its composition was so multiple that one recipe mentions no less than 250 ingredients. It was a modification of the earlier compound called "mithridatium," which derived its name from Mithridates VI, King of Pontus (132–63 B.C.), who discovered that he could immunize himself against poisons by the use of gradually increasing doses of them. The physician to the court of Mithridates was Crateuas, who made such accurate drawings of plants that he has been called the father of plant illustration. Theriaca, on the other hand, was first compounded by Andromachus, physician to the Emperor Nero, about the year 50 A.D. Such was its popularity that it was described in every herbal and, later, in every pharmacopoeia, and it was listed even in the French Codex of 1884. In England theriaca remained an official drug of the London Pharmacopoeia until 1746, although by that time it no longer contained vipers' flesh and was merely a mixture of opium, caraway, honey, and wine. Its expulsion from the pharmacopoeia followed the publication by Dr. Heberden, in 1745, of his *Essay on Mithridatium and Theriac*, in which he showed that the so-called remedy was quite useless. Someone has remarked of theriaca that "Never has a medicine containing so much cured so little."

MANDRAGORA: AN EARLY ANESTHETIC

One of the most famous drugs of history was the mystic mandrake, Mandragora. This solanaceous herb, with a very long forked taproot, is still common in Greece and elsewhere. The root gives the plant a fancied resemblance to the human body, and there were even male and female mandrakes described in early herbals, the precursors of pharmacopoeias. Mandragora was used as an anesthetic, and Dioscorides stated that after drinking "the wine of the bark or of the root," the patient may be "cut or cauterised," as he is so "overborne with dead sleep" that he does not feel the pain. It is not easy to understand how such a nonvolatile preparation could be used as an anesthetic by inhalation: nevertheless it was a common practice to mix opium, mandragora, and henbane with water and to hold this mixture to the patient's nostrils on a sponge—the so-called *spongia somnifera* mentioned by Nicolas of Salerno in his *Antidotarium*, compiled in the eleventh century. Shakespeare has many references to mandragora, "the insane root that takes the reason prisoner." This refers to the gathering of the plant, which was not without danger, as it was believed that the mandrake, when uprooted, uttered a shriek that caused either death or insanity to all who heard it. Accordingly the root was first loosened and then tied to a dog, which completed the process of uprooting and then fell dead. Medieval illustrations often show how the mandrake root has been used as a tether for the dog. (Figure 1.)

CINCHONA AND QUININE

The discovery of America added largely to the number of drugs in the sixteenth century, and for many years new vegetable remedies continued to arrive from the Western Hemisphere. Among them was quinine in the crude form of cinchona bark, and its discovery forms a romantic story. About 1630, the Countess of Chinchon, wife of the Viceroy of Peru, was cured of a fever by the use of a native remedy prepared from the bark of a tree. It became known as the "Countess's Powder," and large quantities were distributed to the people of Lima by the Countess, who also introduced the drug into Spain. In this way, cinchona, as it was called after Linnaeus had omitted, in error, the first "h" of the word, became widely known in Europe. In England it was used as a secret remedy by Sir Robert Talbor who acquired a large fortune in this way, and, later, it was popularized by the leading physician Thomas Sydenham. The legend of the Countess of Chinchon has been disproved, as, it seems, she never went to Peru at all but lived and died in Spain, and it has also been shown that cinchona bark, or quinaquina, was often confused with Peruvian bark, from an entirely different tree, which yields balsam of Peru. Errors of this nature are not uncommon in the history of drugs. So many cinchona trees were cut down that there was a danger, early in the nineteenth century, that the supply might entirely fail. Charles Ledger, a Londoner who was buying alpacas in Bolivia, collected a quantity of cinchona seeds and offered them to the British Government. The offer was rejected, but the Dutch Government, with greater foresight, bought them for about a hundred dollars. From those seeds, in Java, were raised the plants that formed the nucleus of a vast industry, which yielded tons of

FIG. 2. The Vegetable Lamb from a paper by Sir Hans Sloane in Phil. Trans. 1698. He wrote: "The Tartarian Lamb is a foot long, as thick as one's wrist, and having some foot stalks. The down growing on it is used for spitting of blood, the powder is inhaled into the wind pipe. In the trials I have seen, I am sure it is not infallible."

quinine and millions of money. Today, quinine has been largely superseded by other remedies, but the story of its appearance is a landmark of history.

Among other plants introduced from the New World was tobacco, and one of the first illustrations of the tobacco plant appears in the book by Nicolas Monardes of Seville who, although he never visited America, set himself to study the effect of many of the new plants. His work was translated into English in 1577 by John Frampton, who gave it the quaint title, *Joyful News out of a New-found World*. Another remedy that owes its popularity to folklore is digitalis. For many years an infusion of foxglove leaves was used by the country folk of Shropshire, England, as a cure for dropsy. This fact, noted by Dr. William Withering while practicing among them, led to the introduction of the plant into regular pharmacy. In his book, which has become a medical classic, *An Account of the Foxglove*, published in 1785, Withering described 163 cases of dropsy treated by digitalis. At that time dropsy was regarded as a disease and not merely as a manifestation of cardiac or renal disease. Withering did, however, recognize that digitalis had "a power over the motion of the heart to a degree yet unobserved in any other medicine."

THE LEGEND OF THE VEGETABLE LAMB

Many of the early works dealing with plants and their uses in medicine, or "herbals" as they were called, describe various curious drugs and remedies. In 1597, John Gerard depicted in his *Herball* many of the plants that he grew in his large garden at Holborn, London, including the potato, which was then quite a novelty.

He also described the goose tree, or barnacle tree, which produced shells upon its branches from which young barnacle geese were hatched out and then flew away.

One of the strangest plants of all was the vegetable lamb. Perhaps the first illustration of this curious plant is that which adorns the title page of the botanical work by John Parkinson, the last of the great herbalists. The book is entitled, *Paradisi in Sole, Paradisus Terrestris*, the "Park in Sun" being a play upon his own name, and it appeared in 1629. The vegetable lamb was a creature that grew upon a stalk and that died after it had eaten up all the foliage within its reach. It was described and illustrated by Elizabeth Blackwell in her beautiful herbal dated 1737 and entitled *A Curious Herbal*. The hairs of the "animal" were used as a hemostatic, and this remedy was discussed by Sir Hans Sloane in a paper to the Royal Society in 1698, although by that time it had become obvious that the plant-plus-animal was merely a species of fern that bore a remote resemblance to a lamb. (Figure 2.)

CONCLUSION

A great deal more might be written regarding the strange drugs and remedies of early times, but enough has been said to show the interest of this aspect of medical history, so peculiar to our enlightened minds, yet representing the first stages of the agelong war against disease.

The Physician as Alchemist*

MEDICAL IDEAS IN THE ARABIAN EMPIRE

Félix Martí-Ibáñez, M.D.

EDITOR OF INTERNATIONAL RECORD OF MEDICINE AND GENERAL PRACTICE CLINICS

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Tawaddud, the fabulous slave-girl. Arabia before Mohammed. The advent of the Prophet. In the wake of Mohammed. The Arabic civilization, mosaic of races. The Nestorians and the Persian origins of Arabic Medicine. The work of the Syrian translators. Rhazes, the experimenter. Avicenna, the prince of Arabic Medicine. Moslem Spain. The Western Caliphate: Medicine in Cordova. Albucasis, the surgeon. Avenzoar, the clinician. Averroës, the philosopher. Maimonides, the humanist. The Arabs in History. Arabic contribution to Medicine: (1) Medicinal chemistry; (2) The organization of pharmacy; (3) The founding of hospitals. Colophon.

TAWADDUD, THE FABULOUS SLAVE-GIRL

It happened in medieval Bagdad.

"When it was the 436th night, Shahrazad resumed her story, saying, 'And among my tales is that of Abu al-Husn and his slave-girl Tawaddud.'"[1]

Abu al-Husn was the prodigal son of a rich merchant of Bagdad. When his father died, Abu al-Husn squandered his inheritance by listening too long and too often to the "giggle of the daughter of the vine as she gurgled from the flagon," and the jingle of the silver anklets worn by the slave girls as they danced to the rhythm of the lutes. Only one slave girl called Tawaddud remained with him, a girl with "eyes like gazelles' eyne, with strait arched brows twain, as they were the crescent moon of Sh'aban, and nose like the edge of scimitar fine, cheeks like anemones of blood-red shine, mouth like Solomon's seal and sign, and teeth like necklaces of pearls in line." In addition to these divine gifts, Tawaddud boasted of a navel "holding an ounce of oil of benzoin," and "hind parts heavier than two hills of sand."

This fabulous creature one day suggested to her impoverished master that he sell her to the Caliph Harun al-Rashid for ten thousand dinars, which money would rescue him from his financial plight.

Once in the presence of the Caliph, amid silks, tambourines, fountains, divans, lutes, geraniums, pillows, and mosaics, Tawaddud offered to answer all questions put to her on "syntax, poetry, jurisprudence, exegesis, philosophy, the Divine ordinances, arithmetic, geodesy, geometry, ancient fables, the Koran, the exact sciences, medicine, logic, rhetoric and composition, the lute, dancing, and fashions."

The questioning of Tawaddud by a solemn jury made up of the sensual Caliph and the most learned men in his empire occupies twenty-six nights (436th to 462nd) of *The Thousand and One Nights*. Tawaddud provided wise and correct answers on all the above-mentioned subjects. Her answers to the questions on medicine,

* "The Physician as Alchemist" is a chapter from *Centaur: A Biography of Medical Thought*, which is a work in progress by Dr. Martí-Ibáñez. The bibliography for this chapter will be included in that volume.

anatomy, and physiology give us a faithful picture of medical knowledge during the Golden Age of Arabic Medicine.

Tawaddud explained that man, according to the Koran, had 249 bones, 260 veins, and "three souls or spirits—animal, rational, and natural—," and that "Allah made him a heart and spleen and lungs and six intestines and a liver and two kidneys and buttocks and brain and bones and skin and five senses," and that "the heart He set on the left side of the breast and made the stomach the guide and governor thereof. He appointed the lungs for a fan to the heart and established the liver on the right side, opposite thereto. He made, besides this, the diaphragm and the viscera, and set up the bones of the breast and latticed them with the ribs."

In the slave girl's subsequent answers we get snatches of Talmudic anatomy, Galenic physiology, Hebraic clinical experience, and Mesopotamian astrology, all of which had been incorporated into Arabic science.

Then Tawaddud explained the principles of diagnosis based on the "patient's actions, what is evacuated from his body, the nature of the pain and the site thereof, swelling and the effluvia given off his person," adding that "a physician who is a man of understanding is guided by the feel of the hands, according as they are firm or flabby, hot or cool, moist or dry," as well as by the patient's eyes. She described the symptoms of illnesses caused by variations in the bile, and advised bread sopped in broth and mutton meat as the most profitable to man, but she condemned fermented liquors. She explained when and how cupping should be applied and vegetable medicines administered. "He who would live long," she advised, "let him be early with the morning meal and not late with the evening meal; let him be chary of such depletory measures as cupping and blood-letting; let him make of his belly three parts, one for food, one for drink, and the third for air." She recommended walking gently, for "it will be better for the body and more in accordance with the saying of the Almighty: 'Walk not proudly on the earth'." She also extolled the virtues of copulation, explaining that moderate indulgence "lighteneth a body full of black bile, dilateth the heart, calmeth wrath and banisheth trouble, and is good for ulcers," but she warned that copulation with old women was "deadly."

The silver tongue of the lovely Tawaddud affords us an outline of the medical knowledge of the fourteenth century. If a slave girl, however intelligent, could accumulate such a treasure of medical science, we can safely surmise the extraordinary amount of knowledge that an Arab physician of that period must have possessed. By restoring the colors, faded by the passing of centuries, of the luxuriant tapestry of Arabic Medicine, we shall be better able to understand the history of medieval Europe and the magnitude of the legacy inherited by modern medicine from the Arabic world.

ARABIA BEFORE MOHAMMED

The geography of Arabia has changed little since the times when the rocket of Mohammedan civilization burst over the horizon of the ancient world.

At the beginning of the seventh century, Arabia was a vast wasteland surrounded

by flourishing cultures: the Chaldean, the Assyrian, the Egyptian, and the Mediterranean. Through the center of the Arabian peninsula stretched an immense desert of burning sands whipped by terrible storms, but bordering this barren country, strips of pasture lands and bits of productive soil formed a belt of fertile promise extending from Yemen all the way to the south.

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Arab physician reducing a dislocation of the shoulder by suspending patient on a pole held by his assistants. From Persian treatise on surgery translated into Turkish.

Before the seventh century Arabia was made up of nomad tribes of Bedouins and of sedentary farmers huddling near wells and springs. Self-defense had spurred these farmers to construct walled cities like Medina and Mecca, with clumps of palm trees, wells with bitter tasting water, and populations of fifteen to twenty thousand inhabitants. Medina, inhabited by Yemenites, was more exposed to the influence of Judaism, Christianity, and Zoroastrism. Mecca was inhabited by Bedouins, and its walls protected men with a thirst for knowledge that manifested itself in poetry and singing contests.

The nomad tribes, on the other hand, preferred to wander incessantly over interminable routes across oceans of sands, alternating days of warring adventures with nights of story-telling, huddled around the fire under the cold lofty stars while camels and scimitars rested nearby. Each tribe chose its own chief and even its own god. One of these gods was a meteorite that had fallen on the sacred city of

Mecca and around which a Kaaba was built like a casket. To this crude black basalt temple the faithful flocked at least once a year from everywhere.

Before the appearance of Mohammed, the neighboring lands, viz., Egypt, the Mediterranean coast, and Mesopotamia or the Land of the Two Rivers, had been overrun by Semitic invaders who mixed with Sumerians, Babylonians, Assyrians, Phoenicians, Egyptians, and Canaanites. Arabia's strategic geographical situation—it lay like a wedge between Egypt, Palestine, and Mesopotamia—made of it a stopping-point much coveted by the hierarchs of the ancient Oriental Empires. On numerous occasions, these neighboring empires had attempted to subjugate Arabia, and in name at least incorporated it to their imperial possessions. They even introduced the "Saracens"—as the Romans and Persians called the nomad Arabs—into the folklore of their legends.

THE ADVENT OF THE PROPHET

As has happened so many times in history, the trigger that set off the tremendous Arab explosion was released by the word of one man.

At the beginning of the seventh century there suddenly appeared in Arabia an ignorant merchant who, like the Buddha who retreated to the hills and Christ who retired to the desert, decided to withdraw to his tent and even covered his head completely with his burnoose to intensify his introversion. And the anonymous fanatical merchant who entered the tent emerged as Mohammed, a prophet illuminated by a message.

This happened at a time when the Byzantine empire was being ravaged by a plague (probably bubonic plague) that had originated in lower Egypt and, in the space of a few years, had caused ten thousand deaths in Constantinople. The corpses were piled up in the wall-towers which once filled were sealed up to protect the survivors.

In this decadent and disintegrating empire of lovely mosaics and exquisite stained-glass windows, Mohammed, the prophet of Allah, started to preach, impelled by the dream of uniting all the nomad tribes of Arabia within the iron bonds of a single religion. Some tribes remained faithful to the gods of Mecca, but others readily accepted Mohammed's message. Had he not promised them a paradise, with innumerable couches for every warrior, where perfumed sensual houris, their eyes as black as the night, awaited them wrapped in the somnolent drowsiness of a heavenly seraglio?

Mohammed was born in Mecca. In his youth he worked as camel driver for a rich widow called Kadija whom he later married. He led the life of a prosperous merchant until, at the age of forty, he was seized by the urge to go forth and speak of a religion that would replace the pagan gods of Mecca with a single god.

Faced by a growing hostility in Mecca, Mohammed sought the support of Medina, whose inhabitants had already felt the influence of other religions. At the age of fifty-one, Mohammed had to flee Mecca (a flight known to History as the Hegira), and after many a mishap crossing the desert he took refuge in Medina. From this

city for several years he waged constant battle against his enemies—Bedouins, Jews, and nomad tribes—until he finally subjugated all Arabia.

Mohammed died at the age of seventy-two. This fanatic, lusty man had one redeeming feature: his passion for books, the result of an illiteracy that made him long for culture as for some forbidden fruit. The Arabs, fervent lovers of books, later came to divide people into "those who owned books and those who did not," possibly in memory of the time when Mohammed, wishing to extol his god to the highest degree, said that it was Allah who had "taught man to move the pen."

IN THE WAKE OF MOHAMMED

The Arabic conquest of the ancient world—starting in 622 A.D., the first year of the Mohammedan calendar—is a tremendous explosion of sheer will, a supreme collective manifestation of fanatic ambition for power. Mohammed was dead, but the trail he blazed with his preachings remained. And the Arabian surge kept rolling implacably. Under the leadership of Abu Bekr and Omar I, the Arabian empire expanded by giant leaps until it stretched from Medina to Finisterre.

At first, Arabia sent emissaries to neighboring countries inviting voluntary submission. When this did not succeed, the Arabic swords glittered under the sun of History. One after another the neighboring countries succumbed, even powerful Persia whose emperors used elephants trained for battle: in the glow of a scarlet twilight, both pursuer and pursued stared in amazement at the huge gray beasts, fatally wounded, staggering through their lines.

The young Arabian warriors, not satisfied with dragging their multicolored hooded garments over the hot sands of Arabia, spurred their horses and, with the winds of the new Mohammedan gospel howling behind them, reached India, swallowed up Persia, devoured the Caucasus, invaded Sicily, and finally cut a wide crescent into Spain when Tarik leaped from Africa to Gebel-Tarik or the mountain of Tarik, later called Gibraltar, and created the Western Caliphate in Cordova.

This vast empire, which began with the Caliphate of Bagdad in the eighth century, came to an end with the sack of Bagdad by the Tartars in the thirteenth century, the expulsion of the Arabs from Spain, and their defeat in the East by the Turks.

THE ARABIC CIVILIZATION, MOSAIC OF RACES

The Arabic civilization, therefore, comprised a conglomerate of peoples—united only by the same language—of which but a few were born in Arabia and the rest were Syrians, Persians, Spaniards, Mohammedans, Christians, and Jews. For the Mohammedans were as tolerant as the primitive Christians were intolerant. Perhaps that is why Christianity was able to survive. Arabic monotheism was the most precious tool used by the Mohammedans to unify their conquests. The real objective, however, of their campaigns was the conquest of pleasure, on earth as well as in heaven. A materialistic, indolent, sensual, and skeptical people, the Arabs accepted their religion as a self-imposed moral law, but never attempted to impose it on the peoples they conquered. They never forced anyone to accept their

religion; they required only that the Koran be recognized as the vehicle of the divine word, and since the sacred book was written in Arabic, the conquered peoples had to learn the tongue of the victorious invaders. Thus the vast Moslem Empire came to be united by one single language. Before the acceptance of Arabic as the "official" language among learned men, Greek was the preferred language, later replaced by Syrian in west Asia; but from the ninth century on, both the humble rug vendor in the public market and the haughty physician at the Caliphs' courts spoke in Arabic.

The only other term imposed by the Arabs upon the conquered peoples was the surrender of Greek manuscripts. At the end of the eighth century, all of Arabic knowledge consisted of a translation of a Greek medical book and a handful of books on alchemy, but before the end of the ninth century the Arabs were already in possession of all the Greek sciences. The glory of Greece vanished and the might of Rome destroyed, there remained the work of the Byzantine copyists and the Arab translators as the only bridge of light spanning a thousand years of darkness until the outburst of light in the Renaissance.

During this historical transition from classical Greece to the Arabian Caliphates, a vital role was played by the Syrian translators. Except for medieval Spain, never in History have translators played such an important part as they did at the beginning of Islamic expansion. Thanks to their work, the Arabs could add the dazzling treasure of the philosophical and medical knowledge of Periclean Greece to their war booty.

THE NESTORIANS AND THE PERSIAN ORIGINS OF ARABIC MEDICINE

Medicine was one of the most important facets of Arabic culture during the halcyon days of Mohammedan civilization. Arabic medicine joined Byzantine and monastic medicine to provide the three channels through which medieval medical thought flowed.

In order to understand Arabic medicine it is necessary to cast a glance back at its Persian origins. Two centuries before the birth of Mohammed there lived in Constantinople one Nestorius, an Aramaic priest of eloquent tongue and subtle metaphysical mind, who was named patriarch of the city in the year 428. At a time when Christianity still glowed with the light kindled by Saul of Tarsus, Nestorius dared found a religious school which challenged Christian dogma by attributing two personalities and two natures to Jesus Christ and by proclaiming that the Virgin Mary was not the Mother of God, but the mother of Christ. Because of this slight semantic difference, Nestorius was denounced by the Council of Ephesus (431 A.D.) and banished from his native land.[2]

Nestorius and his followers fled to Edessa (today Orfa) in upper Mesopotamia and later moved on to Djondisapur in southwestern Persia, where they founded a school of medicine that lasted until the tenth century and was the cradle of Arabic medicine. For the Nestorians, forced to abandon theology because of the lack of dialectical opponents with whom to argue out theological subtleties, had turned to medicine. Since their aspirations to heal man's soul had cost them so dearly, they decided to heal man's body.

Disappointed with their own times, the Nestorians turned their gaze back to classic Greece, drinking deeply of the medico-philosophical waters of the Greco-Roman school. Later, generous with their newly acquired knowledge, they poured the ancient Hellenic nectars into Syriac molds by translating Greek medical works into Syriac in the hope of continuing the brilliant Hippocratic tradition and by establishing medical schools in Edessa and other Persian towns.

When the Arabs therefore conquered Persia, they suddenly found their shepherds' pouches filled with the medico-philosophical treasures of the Greeks recorded on old Nestorian parchments.

THE WORK OF SYRIAN TRANSLATORS

Arabic medicine, therefore, was of Persian and, indirectly, Hellenic origin; it represented not a uniform canvas but a multicolored mosaic of races and nations held together by the sword and the prestige of the Saracen crescent.[3]

In the year 700, when the Umayyad Caliphs were reigning in Damascus, learned men—mostly Nestorian Christians—migrated to the Islamic capital. The Nestorian physicians and the graduates of the school of Djondisapur took care of the first Caliphs. Their medical emissaries often travelled to Salerno where the first European medical school was located; thus they established the first "official" medical link between Asia and the western world, later continued by the schools of Bologna and Padua during the Renaissance.

The rise of the Abbasid Caliphs (750), with Bagdad as their capital, inaugurated the Golden Age of Arabic civilization. Medical literature had not yet made an appearance in the Arabic dress. The second Abbasid Caliph, Abu-Ja'far al-Mansur, recognized the need for translating Greek works into Arabic. Once when he was sick he sent for the chief physician of the hospital of Djondisapur, the Nestorian Jurjis ibn Bukht-Isho, the first of a dynasty of no less than seven generations of eminent physicians and translators. Impressed by the physician's knowledge, the Caliph extended Greek medical science all over his empire. To the Bukht-Isho family belonged Kibrail Gabriel, physician to the fifth Abbasid Caliph, Harun al-Rashid, who made a fortune of three million dollars and became one of the wealthiest physicians in History, and Hunain ibn Ishaq, who translated into Arabic almost the whole immense *corpus* of Galenic writings and other works and received in payment the weight in gold of all the manuscripts, among them *Ten Treatises on the Eyes*, the most famous Arabic text on Ophthalmology.

The production of books at this time was facilitated by the introduction of paper invented in China and imported into Arabia to replace papyrus and parchment.

In the ninth century, Syrian translations from the Greek were made for Christians and Arabic translations for Mohammedans. The Abbasid Caliph al-Ma'mum (reigned 813–33) instituted a regular school in Bagdad for translation equipped with a library, and encouraged Arabic translations of Greek works by offering generous fees and by sending learned men to Alexandria in search of Greek manuscripts.

And so the Arabs, then masters of half the world, attempted to acquire the knowledge that was the only pearl missing in their crown.

The heroes, therefore, at this stage in Mohammedan medicine were the translators. To the two most famous families of translators, the Bukht-Isho and the Messuas, should be added the "prince of translators," the Syrian Christian Honein, or Joannituius (809–873), who translated almost all the works of Hippocrates, Galen, and Aristotle.

Prominent at the court of Caliph Noavia I was the brilliant physician Maser Mjawah Ebu Djeldjal of Basra, who translated into the Arabic the *Pandects* of Haroum, the Alexandrian physician. Under the auspices of Harun al-Rashid, the Rabbi of Seleucia, Joshua Ben nun, converted Bagdad into an international intellectual oasis.[5]

Those were happy times when even beneath the warrior's shield beat a soul avid for culture. When Michael III of Constantinople was defeated in battle, the penalty imposed upon him was that he send a caravan of camels laden with ancient manuscripts to Bagdad. On one occasion, an Arab sheik offered a powerful friend of his not a precious jewel, but a manuscript of Dioscorides. The book was mightier than the sword! Other schools began to flourish in Samarkand, Ispahan, Alexandria, Sicily, and later in the Spanish cities of Cordova, Seville, Toledo, Granada, and Saragossa.

During the ninth century, medical practice was in the hands of Christians in Bagdad. If a physician bore a foreign name instead of Mohammedan, spoke Syrian or Persian instead of Arabic, and wore black silk instead of white cotton, he could be assured of a great many more patients than a Mohammedan physician. This predilection in every country for foreign physicians is an interesting phenomenon of medical sociology still observable in our own times.

The first great book written at that time was concerned with pharmacology: it was the *Great Book of Medicine* of the Christian Sabur ibn Sahl, the first director of the hospital of Djondisapur and physician (850–869) to al-Mutawakkil, Caliph of Bagdad. For three centuries this book was a basic text at the hospitals and pharmacies of Bagdad and Persia. The Persian al-Tabari, who was converted to Islam when already a man, wrote *Paradise of Wisdom*, in which he studied the entire therapeutic armamentarium of the Arabs. In its pages we find mentions of tamarinds, melon seeds, sugar candy, sandal, nux vomica, senna, indigo, manna, Arabic gum, resins, sugar cane, cocoa, betel nut, areca nut, and bamboo, as well as recipes of incense and essences. Although Indian medicine did not influence Arabic medicine, Indian drugs enriched the Arabic pharmacopoeia.

Pharmacology more than any other branch of medicine seems to have fascinated the Arabs. Century after century there was not a single medical writer who did not devote some of his writings to this science, thus incessantly increasing the list of medicaments which already swelled Arabic pharmacy. Arabic pharmacology spread throughout Persia in the tenth century in the form of works written in Neo-Persian. In one of these books, written by Abu Mansur Muwaffaq, 549 medicaments and their effects are mentioned, and in the *Hami* (thirteenth century) 1,400 drugs are studied.

RHAZES, THE EXPERIMENTER

The first of the four great medical figures—Rhazes, al Tabari,[6] Haly Abbas,[7] Avicenna, all Arabs or Persians—of the Eastern Caliphate was Abu-Bakr Muhammad ibn-Zakariva al Razi (c. 860—c. 932), called Rhazes because he was born in Raij (Tabaristan, northern Persia) near present-day Teheran. Because of his Hippocratic spirit, Rhazes won for himself the noble name of "the Experimenter." Rhazes, who in his youth was more interested in music than in medicine, did not begin his medical studies until the age of 40, on the occasion of a visit to Bagdad. It is not unusual in the history of medicine to find men whose interest in this science was aroused late in life and yet achieved great fame, as if all their earlier years had been a sort of prelude to their consecration to science.

Rhazes became chief physician at the great Bagdad hospital where he had been educated, an honor vouchsafed to few doctors. Because of his important post, his services were much sought by the nobility of several Persian courts. He practiced in Raij and Bagdad. It is said that once, anxious to choose the very best site on which to build a hospital, Rhazes hung out pieces of meat and buried others at several points in the city, and then had the hospital built where the meat took longest to rot. This experiment in medical ecology showed his great perspicacity and wisdom.

Rhazes was an eminent historian and philosopher and a clinician of the stature of Hippocrates, Areteus, and Sydenham.[8] In opposition to the polypharmacy of his time, he recommended spareness in therapy and sobriety of treatment; he preferred a scanty remedy to the copious pharmaceutical bill-of-fare served at the banquets of Arabic chemistry.

Rhazes compiled over two hundred volumes on philosophy, religion, mathematics, and medicine. His *opus magnum* is *Kitab al-Hawi Li'l-tibb*, or *Liber Continens*. Of almost equal importance is his little book *Mansurio* or *Liber medicinalis ad Almansorem*, dedicated to Almanzor the Victorious, and still consulted in Elizabethan London at the time of the plague. The *Liber Continens* is a gigantic compilation of all Arabic medical knowledge at the beginning of the tenth century, and can be considered one of the greatest books in the history of medicine. The first edition weighed over 22 pounds and is one of the heaviest incunabula extant. The ninth book of the *Liber Continens*, translated by Vesalius, was the principal source of therapeutic knowledge until after the Renaissance.

Andalusian, Arabic, Persian, Berber, Egyptian, and Hebrew students came to listen to Rhazes the physician speak the magic words "according to my own experience."

Unfortunately, Rhazes quarreled with the hierarch of Bokhara, who ordered that he be beaten over the head with his own book until one or the other broke. Rhazes's head broke first. The lesions caused by this "intellectual" beating brought on blindness in Rhazes's later years. A true philosopher, he refused to be operated on because "he had already seen enough misery in this world."

AVICENNA, THE PRINCE OF ARABIC MEDICINE

The greatest medical figure of the Eastern Caliphate and one of the greatest physicians in all of History, a man whose encyclopedic knowledge has earned him comparison with Aristotle, Leonardo, and Goethe, was the Persian Abu 'Ali al Husayn ibn'Abdullah ibn-Sina (980–1037), generally known by the latinized name of Avicenna.

The so-called "prince" of Arabic physicians and author of the most famous book ever written in the history of medicine was born in Kharmesan, near present-day Bokhara. A child prodigy, at the age of ten he knew the Koran by heart, a feat difficult even for a wise man of mature years, and had also mastered the *Isagoge* of Porphirius, the *Geometry* of Euclid, the *Almagest* of Ptolemy, and Aristotle's *Metaphysics* which he reread more than forty times. In his early teens he studied Indian philosophy, numerology, logic, and jurisprudence.

At the age of eighteen Avicenna cured the king of an illness, whereupon he was appointed royal physician and granted, as a special reward, access to the royal library. To one as hungry for knowledge as Avicenna, it was like opening the doors to Paradise. Legend has it that when he had learned by heart everything of any value in the vast library of the Ammanides, he set fire to it to hide the source of his knowledge.

When the Sammanide dynasty came to an end, Avicenna fled to Khiva and Rai where he wrote a great many books, and then on to Kazwin. In Hamadan he cured the Emir Shams Addayla of colic and in reward was appointed Prime Minister. When the Kurds rebelled against such an unqualified political appointment, Avicenna hid in the house of a friendly sheik, a refuge he left when the Emir fell ill again with the colic; Avicenna cured the ruler once again and was appointed vizir.

Avicenna was a peerless scholiast in Arabic, Latinity, and dialectic, and the definitive codifier of Greco-Latin medicine. His life was an extraordinarily active one. During the day he practiced medicine and performed the duties of the statesman. At night he studied, dictated his works, and gave lectures. When the stars were already pale in the heavens, Avicenna would interrupt his meditations to engage in more material entertainment; it was then he gave himself over to old wine and young maidens. When he laid away the pen that wrote of mathematics, astronomy, physics, chemistry, geology, philosophy and theology, poetry, music, and medicine, the lute played, wine flowed, and girls danced.

It was a strange adventurous life he led, punctuated by flights, disguises, voyages, and political honors. When a problem was especially difficult he would withdraw to a mosque to pray until he felt illuminated by his inner light, or he would retire to sleep and let his subconscious solve the problem in his dreams. Some historians have believed him to be the author of the *Rubáiyát*, of Omar Khayyám, but although Avicenna's personal philosophy is comparable to that of Omar Khayyám's poem, attribution of authorship is nothing but poetic license.

Avicenna's philosophy is worthy of Plato. His writings are at times frankly Platonic in their allegories, as when he compares men to caged birds that are liberated from their prison only by the Angel of Death. He admitted the influence upon

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Avicenna (980–1037), Arab physician and philosopher, being received by the Sha of Isfahan after his expulsion from the court at Hamadan.

the physical world of souls dwelling in celestial regions, and believed in the omnipotence of spiritual forces to crystallize in action and matter. A thought could make a camel in the desert move; victory over a rooster would make a hen so proud that she could grow spurs.

The vizir's baton of authority, the cutlass in the *razzias*, the lute, wine, and women, along with excessive work, proved to be too much even for Avicenna. At the age of fifty-eight he felt that death was near. He accepted his approaching end philosophically, distributed his wealth, read the Koran from beginning to end several times in periods of three days, and died during the holy month of Hamadan. His tomb in the ancient romantic Ecbatana of the Oriental poets is still a shrine.

Avicenna's *opus magnum* was his *al-Quanun fi 'al-Tibb* or the *Canon Medicinae*, which runs to a million words and made of Avicenna the dictator of world medicine during the long period from the coming of the *almorávides* to Spain to the advent of Vesalius. It was the medical bible for several Asiatic and European civilizations for more than six centuries and was considered an infallible oracle. If Galen dominated the medicine of the ancient world, Avicenna ruled medical thought during the Middle Ages.

In the thirteenth century the *Canon* was translated into Latin in Spain, and in the fifteenth and sixteenth centuries was reprinted almost thirty times in Latin. It is a book as monumental in facts as it is in errors. Each page is a garden where the weed grows next to the rosebush. For example, Avicenna attempted to deduce the pharmacological properties of drugs from their taste, color, and odor, and ad-

vised such treatments as the insertion of a louse into the meatus of patients suffering from the retention of urine.

The *Canon*, epitome and summary of Greco-Latin medicine, achieved for the Arabs what Galen's works achieved for the Romans: complete and absolute authority. To criticize it was considered sacrilege. In 1650 the *Canon* was still used as a text at the universities of Montpellier and Louvain, and today it is still applied in the East.[9]

Avicenna, the greatest physician of the eastern Caliphate, died in 1037, but almost a thousand years later his system continues to heal the sick of Persia.

MOSLEM SPAIN

The history of Arabic Spain is the history of medieval Europe and its medicine.

The conquest of Spain by several thousand Arabs and Berbers lasted five years. The reconquest of Arabic Spain by Catholic Spain lasted eight hundred years. This difference in time provides the key to the secret of Arabic Spain.

Musa, governor of north Africa, and his lieutenant, Tarik, conquered Spain with twelve thousand Arabs and Berbers who came to the Iberian peninsula without their families and married Spanish women.

"I do not understand," Ortega y Gasset has said, "how something that lasted eight centuries can be called '*Reconquista*.'" One should remember that the Moslems of the Iberian peninsula were true Spaniards in temperament and spirit. The Arab Abderraman III, King of Spain, was as much a Spaniard as the Spaniard Trajan, Emperor of Rome; Arabic Averroës, who was born in Cordova where he lived and prospered all his life, was as Spanish as the Spanish-descended Seneca, who was also born in Cordova but lived and worked in Italy.

During the Moslem domination of Spain, the Iberian peninsula was shaken by continuous wars, yet in the intervals between these wars, Christians, Mohammedans, and Jews learned to live together in relative harmony. The Berbers and the *almorávides* and their enemies the *almohades* (the unitarian Moors of Morocco), as well as other natives of north Africa converted to Islam, were the most fanatical, as has always been the case with religious converts. But to the Arabs themselves Islamism and unitarianism were only tools with which to achieve their conquests and an ultimate goal: pleasure. It is true that the Arabs were given to pillage, but as soon as they attained their goal, religious tolerance became the rule. The *mozárabes*, or Christians acclimated to Islam, and the *mudéjares*, or Mohammedans who accepted Christianity, received better treatment at the hands of Islam than the *marranos*, or converted Jews, and the *moriscos*, or converted Mohammedans, later received at the hands of the Christians. Christians and Mohammedans observed the same religious festivals and often worshipped in two separate wings of the same temple. The Jews, who had been persecuted by the Visigoths, went over to the Arabs and became prominent figures in the intellectual renaissance of Cordova and Toledo.

The Arab communities were always of tribal, and often nomadic, character. Because these warriors did not bring their families to Spain, as the Visigoths before

them had done, they married Christian women and created Celtiberian, Visigothic, and Afro-Semitic mixtures in Andalusia. It was the scions of such Andalusian stock who set sail from Cadiz and Seville for the New World.

The Western Caliphate, which succeeded the Caliphate of Bagdad in importance, endowed Spain with a progressive cultural organization. Literature flourished together with art, science, and philosophy; libraries were constructed along with schools and hospitals; medical societies were established, and agriculture and industry developed. Except in mathematics and literature, the Mohammedans were assimilators and transmitters rather than creators. Their architecture, rich in domes and profusely ornamented planes which can still be seen in North Africa, derived from the Byzantine; the inside cloistered *patios* of their houses in medieval Spain derived from Rome; their medicine derived from Greece through Syria and Persia—all of which seems to indicate rather uninventive minds. But if we come down from the lofty disciplines of the mind to more earthy matters, we observe that the Arabs were responsible for notable progress in everything having to do with bodily comfort. The Arabs subordinated the soul to sensual delights. That is why even their religious paradise is endowed with all physical comforts and pleasures, including numerous houris. Their cities attested to the fertility of their gift for material comfort and pleasures, for they boasted of glass windows, street lights, spices, drugs and perfumes, gardens, and stringed instruments.

THE WESTERN CALIPHATE: MEDICINE IN CORDOVA

Once the Arabs were definitely established in Spain, the Western Caliphate of Cordova (755–1236) began to achieve great prosperity under the Spanish dynasty of the Omniades. Their greatest medical writers were the surgeon Albucasis, the philosopher Averroës, and the Jewish physicians Avenzoar and Maimonides, all of whom were born in or near Cordova. It is difficult to understand why Spanish historians even today, guided by a false patriotism, do not consider these four men, who wrought a glorious page in medieval Spanish history, as Spaniards.

The capital of Moslem Spain was then Cordova, a city of one million inhabitants, three hundred mosques all housing schools, fifty hospitals, a municipal library of more than 225,000 volumes, seventeen universities, and as many public libraries.[10]

This frenzied adoption of ancient teachings, which the Arab clothed in the opulent apparel of his own fantasy, lasted well into the ninth century. The Caliphs became Maecenas to a retinue of studious investigators. At their courts the twanging of the *guzlas* alternated with solemn discussions on medicine. Side by side in every palace were to be found the blue-shadowed seraglio, perfumed with the sensual flesh of the women, and the dim library filled with ancient, musty-smelling, yellowed parchments. During the rule of the Umayyad Caliphs, whose vast empire stretched from Spain to Samarkand, the sumptuousness of the Arab courts provided a setting worthy of the remarkable work of its intellectuals.

Notable analogies exist between the awakening of medicine in the Golden Age of Arabic civilization and that of Renaissance Italy. Arab physicians, like Renaissance physicians, were also philosophers, so much so that the title of *Hakim* applied

to both physicians and philosophers. The medical humanists of the Renaissance had their precursors in Arab physicians. If Renaissance Italy boasted of a *uomo universale* like Leonardo da Vinci, who was physician, architect, poet, musician, sculptor, painter, and geologist, or a Paracelsus, who was philosopher, physician, physicist, astronomer, and geologist, Arabic Spain could point to Abu-Bekr-Zakarias, favorite Koran expounder of the Omniade Caliphs of Cordova, astronomer, naturalist, physician, historian, and outstanding publicist in the *aljamiada* language, and to Geber and Maimonides, whose many-sided achievements are related elsewhere in these pages.

There is even a similar dramatic flavor in the lives of representative men of both epochs. If Leonardo da Vinci led a life of silent loves and of struggle against religious fanaticism, so did Maimonides, who could distil philosophies as vaporous as the flower of sulphur he dissolved in his crucibles; and if Benvenuto Cellini, that brilliant goldsmith and charlatan who bespattered the walls of Rome with the blood of his enemies, filled the Roman streets with his drunken songs and figured in audacious love-escapades, Avenzoar plunged into a wild existence among the gypsies of Albaicin, and Avicenna only too often put his lips to the silver jug filled with warm red wine and roamed the streets plucking the strings of a guitar and singing love songs.

These men of Arabic Spain, fascinated by the marvels of life, tried to discover the secrets of the universe through astrology and alchemy. Their experiments fathered Arabic polypharmacy, that conglomeration of mixtures and unguents, and while their dark hands were busy compounding gilded pills, their minds tried to crack the mystery of space in search of the secret correlations between the position of the stars and the destiny of men.

The Spanish Arabs were not mere compilers of Greco-Latin knowledge. They did more than pour the waters of Greek wisdom into their own receptacles; they added to this water the essence of their intuition, the warmth of their humanism, and the fragrance of their imagination. Bearing witness to their work was the library of Alhaquen II containing 400,000 volumes, which spelled out Arabic wisdom in a rich, vibrant, supple, virile style as perfectly suited for the poetization of Medicine as Virgilian Latin was for singing the glories of Agriculture.

The Caliphate of Cordova (755–1031) by itself could be considered the Golden Age of Arabic civilization just as Cordova may be called the Bagdad of the West. The coming of the Arabs marked an upsurge in Spain's economic wealth. Arab vessels brought food plants from Asia and Africa, while the Arabs encouraged the raising of domestic animals, constructed roads, gardens, and canals, and stimulated the manufacture of silk, embroidery, ceramics, hides, and majolica. In Andalusia and Valencia attendance at school was compulsory for children from the age of six. The closing years of the Western Caliphate saw the creation of the *medressen* or centers of theological, legal, philosophical, and grammatical studies; these were joined to the mosques and had libraries and lecture rooms with professional lecturers.

The Caliphate of Cordova reached its peak with Abdurraman III, who received embassies from the Emperor of Byzantium and Otto I of Germany, and patronized

scientific and medical meetings. Hakem II invited the outstanding scholars of Bagdad to visit Cordova.

Cordova would fall into Christian hands in 1236; Bagdad would be sacked by the Mongols in 1258, and Granada would succumb in 1492. But during the golden centuries of Arabic Spain, Medicine flourished while in the rest of Europe it was buried in the prevailing semibarbarism.

Arabic Spain abounded in families like the Avenzoar family that produced physicians for several consecutive generations, in some cases as many as seven. Statues were erected to physicians, a tribute never again paid to the profession until our day. There even were women physicians despite Islamic restrictions. Latin medical compilations dating from before the twelfth century, and still to be found in the Spanish libraries of those days, looked like poor relatives next to the sumptuous works of the Moslems.

Even during the reign of Philip II Moorish tradition continued. When King Ferdinand of Aragon fell sick, he requested the courts of Valencia to send him a healing woman known as the "dancing Moor of Mislata." Pinderete, a Valencian Moor converted to Christianity, treated Philip II's son, Don Carlos, with an ointment he had invented, notwithstanding the fact that physicians like Vesalius were living at the royal court. The Moorish physician Alonso del Castillo was summoned by Philip II to ferret out and classify Arabic manuscripts at the Escorial.

The first concern of any Arabic city was the organization of a hospital, which in Andalusia served also as an asylum for the insane and destitute. These hospitals attested to the Moslem love of water, for they were embellished with lions spurting water from their mouths; one of these, built by the King Nazari Mohammed V, can still be seen opposite the *Torre de las Damas* in the Alhambra at Granada. Since washing and cleansing were as necessary to the Arab as prayers, they constructed 900 baths in Cordova alone. Mohammedan civilization, born in hot countries, made a fetish of bathing and continued the practice even in the cold climate of Toledo. Christians thought such baths sinful and weakening, and Alfonso VI had them destroyed after the battle of Uccles.

Strange contrast! The Christian Crusades brought nothing but destruction and death to the East; the Arabs were lavish with the treasures of their wisdom and brought progress and prosperity to the West.

Medicine was taught privately. Only after acquiring the necessary general education at the *medressen* and only after learning the art of the mortar and the spatula from some pharmacist did the student enter the service of an experienced physician in whose library he could study medical works bound in fine Cordovan leather embossed with golden or polychrome reliefs.

Cordova became a charming, cosmopolitan city. Its streets bustled with the traffic of caravans from distant lands. A belt of tents marked out the perimeter of the city and there were displayed lovely woven stuffs, rugs and carpets, delicately wrought metals, jewels, glassware, pottery, and dried sweetmeats. In the lazy shade of the awnings, merchants sipped their bubbly drinks fragrant with the essence of lemon and roses. The Arab, who only a few centuries earlier had not

even dreamed of leaving Arabia, learned to live like a Sybarite far from his native soil. In the gardens of the Alcazar of Seville, the Alhambra of Granada, the Alpujarras, and the Albaicin, the indolent Moslems would lazily follow the flight of the bees to and fro, from the flowers to the hive in the hollow trunk of a pine tree, the tiny dots of pollen on their little legs glistening in the sunshine like drops of dew, while carnations, myrtles, sweet basil, passion flowers, lilies, and roses swooned in the sultry air, and the multicolored-tiled fountains spurted water as warm as young blood. At sunset music was heard everywhere; it was here that the *canto jondo*[11] was born.

Astrology and magic were important areas of study for the Arab physician. Arab medicine was the mother of alchemy, which combined with magic. In ancient Chaldean pantheism, the doctrine of an *anima mundi* or a spirit animating all things was applied to any substance that could be extracted from fire. Hence the spirits of wine, niter, and other essences. The seven planets corresponded to the days of the week and to the seven known metals, which were thought to have been engendered in the entrails of the earth.[12] There also prevailed the notion of an elixir of life in the form of potable gold that could cure all ailments and confer eternal youth. Investigation of this *aurum potabile* led to the discovery of *aqua regia* and strong acids, just as the idea of an *elixir of life* led to the foundation of pharmaceutical chemistry.

ALBUCASIS, THE SURGEON

The first great physician of the Cordovan scientific quadrumvirate was Albucasis (abu-al-Qasim Khalaf ibn- 'Abbas al-Zahrawi) (936–1013), a native of Cordova and the greatest surgeon in Arabic medicine. It was Albucasis who recognized the deplorable state into which surgery had fallen and dedicated himself to writing a monumental medical and surgical compilation called *al-Tasrif*, with illustrations of instruments and certain operations common among the Arabs.[13] Oriental revulsion at touching the human body with the hands was responsible for the fact that Arab physicians seldom reproduced ancient surgical drawings. Albucasis's book was the beacon of European surgery until the advent of Ambroise Paré.

That part of Albucasis's book dealing with surgery was based on the work done by Paul of Egina and was the basic surgical text (it was translated many times into Latin, once by Guy de Chauliac) of the Middle Ages until after Salicetus; the section devoted to medicine was copied from Rhazes, for among Arab physicians it was not considered dishonest to copy from one another.

Albucasis's book contains descriptions of cautery, lithotomy, amputations in cases of gangrene, fractures, and obstetrical positions; it praises iron cautery which Albucasis used on more than fifty patients. Albucasis classified operations into "those that do the patient good and those that generally kill him."

Albucasis might be called the Arabic Vesalius, for he dared defy the Koran itself. "Never operate," he told his pupils, "without knowing the exact site of the veins, nerves, and tendons." Like Vesalius, he himself illustrated his text although his religion prevented him from drawing nude bodies, especially of women. He used

bandages hardened with earth, and for the treatment of ulcers he devised bandages with windows. On the other hand, he neglected Obstetrics and Gynecology, which never made any progress among the Arabs, again because the Koran prohibited women from appearing in the nude even before a physician.

At the age of 100, Albucasis, still active as private physician to Abdurraman III, composed his *Liber Servitoris*, a manual for pharmacists, and even engaged in the extraction of dead foeti with serrated forceps in the Caliph's seraglio. His works, translated by Constantine the African, reached as far as Salerno.

Bettmann Archive

Avenzoar, Arab physician in Spain (1091–1162), visited Abdal Mumin, founder of Almohado Dynasty. Woodcut from an edition of Averroës. Venice, 1530.

AVENZOAR, THE CLINICIAN

If Albucasis was the greatest Arab surgeon, Avenzoar was the greatest clinician and physician of the Western Caliphate and one of the few courageous enough to rebel against Galen.[14]

The scion of a Sevillian family which for five generations produced teachers of the Koran, Avenzoar in the daytime would tread the plush carpets in the gilded Alcazar and at night would consort with beggars and galley slaves in the gypsy quarter of the Albaicin. One minute he would be feeling the pulse of the sick, and the next minute he would be plucking Apollo's lyre. Avenzoar rejected Avicenna's *Canon* and was the most Hippocratic of the Arab physicians. His list of antidotes was the bible for toxicologists, while his *Liber Ornamentis*, a book on cosmetics, was "the beloved guide that every Mohammedan woman kept in her sandalwood box."

AVERROËS, THE PHILOSOPHER

Averroës (abu-al-Walid Muhammad ibn-Ahmad ibn-Rushd) (1126–1198), a disciple of Avenzoar and an Aristotelian philosopher, lived in Cordova and, like Aven-

zoar, died in Morocco. He studied law, mathematics, philosophy, and medicine, and was physician to Caliph abu-Ya'qub Yusif in Marrakesh. His master work was the *Colliget*, a treatise containing a complete system of medicine based on Aristotelian philosophy and expounding the pantheistic doctrine that the soul or the nature of man is absorbed upon death into the universal nature. His denial of man's immortality made him a lifelong victim of persecution; along with some of his disciples he was anathematized throughout the Middle Ages.

Averroës's works were burned, and the Infidels spat at him for his heresy while Christian hands nailed his image alongside the anti-Christ in the Orcagna fresco in the cemetery at Pisa. But Averroës's greatest claim to glory is the fact that even his most virulent enemies, Raimund Lull and Saint Thomas Aquinas, were deeply influenced by his theories.

MAIMONIDES, THE HUMANIST

Maimonides (Musa ibn Maymun, Rambam, Rabbi Moses ben Maimon) was born of a prominent Hebrew family, March 30, 1135, in the city of Cordova.

The boy, who loved to play in the narrow sun-baked streets and looked spellbound at the water flowing from the bronze and silver statues into marble troughs, was educated by his father in the Talmud and the Bible, law and science, astronomy and literature. When the intolerant *almohades* occupied Cordova, Maimonides had to flee to Fez where he, his father, brother, and sister, pretended to embrace Islam. Later, Maimonides went with his father and his brother to Jerusalem and from there to Cairo where, after his father's death, he became a dealer in jewelry, although he devoted most of his time to literature into which Abdul-Arab ibn-Muisha had initiated him in Fez. When his brother was drowned in the Indian Ocean, Maimonides found himself laden with debts and a sister to support; it was then that he took time from his literary work and began to practice medicine. In Egypt he married the sister of a royal secretary who, in turn, married Maimonides's sister.

Maimonides became personal physician to the Sultan Saladin, the first Ayyubite sultan of Egypt (1138–1193), a living symbol of Mohammedan unity. The caliphs of Bagdad had then only nominal power; the viziers were the real rulers. One day there arrived in Acre a powerful-looking Englishman wearing a brilliant coat of mail and an enormous sword. It was Richard I of England, the Lion-Hearted, who tried unsuccessfully to acquire Maimonides' services for his own court. But Maimonides had the Egyptian sun to remind him of his beloved Cordova and he refused to exchange it for the mysterious fogs of England.

Maimonides would work until the afternoon in the Royal Palace; then, tired and hungry, he would return home, have some dates, figs, grapes, and fowl, drink the watered wine from his silver cup, and go back to his consultations with Moorish and Hebrew patients. Only Saturdays did he set aside for studying and writing. Sometimes his pen would remain suspended in midair while he would go into a trance, dreaming of the pines and the olive, orange, and lemon trees that perfumed the Cordovan hills under a brilliant blue sky.

Maimonides lived this sort of life to the very end. He preferred to regard Medicine as an art, not as a science; he studied the sick, not sickness; and his actions and thoughts were guided by that teleologic criterion which today governs modern medicine. At the age of fifty, when he thought he would soon die, there was born to him a son. Both the son and a grandson became physicians in Cairo. Maimonides' aphorisms were seeds which took roots in the souls of his descendants.

Meanwhile, while the victorious banner of the Christian reconquest was advancing over Spain, Maimonides was writing books in Arabic which were later translated into Hebrew and Latin and which, along with the works of Averroës, would be decisive factors in the formation of a medico-philosophic school in western Europe.[15]

In all his writings Maimonides rejected astrology and even portions of the Rabbinical tradition, and reconciled reason and faith. In his *Guide for the Perplexed* (1190) he analyzed Aristotle, thus establishing himself as an outstanding philosopher. When he died at the age of seventy (1204), he had already been recognized as a great teacher. But the greatest merit of this scholar lies in the fact that he was always frank about what he did not know. On one occasion he was moved to say (anticipating an idea later expressed by Roger Bacon): "Teach thy tongue to say 'I do not know,' and thou shalt progress!"

THE ARABS IN HISTORY

The Arabs make their appearance in world history with the Islamic explosion, an explosion that was not only religious, but also political and emotional. When the Arabs set out to conquer the world, they were an uncouth people, cruel and primitive in their ways, a horde of men with horses and camels, tents and scimitars, subsisting on goat's milk and palm dates. But they were also a people with a craving for culture and harboring an innate respect for the written word.

Scarcely forty years after the death of Mohammed, the shores of the Atlantic were stained by the scarlet glow of the Arab onslaught. Before the century was out, the banners of Islam waved from the Pyrenees and the Columns of Hercules in Gibraltar to the Heavenly Hills in China. During the course of this astounding cavalcade, the Arabs, who had been only the lords of the winds and sands and knights of the sun and the stars, were suddenly confronted with medieval castles and drawbridges, Roman aqueducts and war machines, medical potions that worked better than any prayer, and mysterious manuscripts soaked in age-old wisdom. And avidly they added to their own scanty knowledge the mysteries of Persia, the Egyptian cabalas, Oriental magic, and Greco-Latin culture. They were wise enough not to enslave the peoples they conquered, as the Romans did, and they even encouraged their search for knowledge. They turned Damascus, Bagdad, and other cities into modern, sophisticated, flourishing metropolises contrasting with the dirty, drab cities of medieval Europe. It was the fame of these eastern cities—marvels of culture and opulence—that provided one of the principal incentives for the Crusades.

Stimulated by their discoveries in the West, they made their own contributions to the general welfare. They perfected fireworks—the polychrome explosion of their

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Attar, or Uttar, pharmacist serving a customer. Simple distilling apparatus is on the left. Neither names nor labels appear on the bottles or jars: probably this was to keep their contents a secret.

colorful souls; put panes into windows, until then covered only by boards; installed lights in the streets; created a numerology that is the basis of our own numerology; established the scientific bases of geology and algebra and especially chemistry, and distinguished themselves for their work in gold, silver, bronze, steel, textiles, glass and ceramics, dyes and paper, sugar cane, viniculture, horticulture, and botany.

The Arabs were not allowed by their religion to perform dissections and therefore accepted without question Galen's monkey anatomy and physiology, but they made three fundamental contributions to Medicine: Medicinal Chemistry in the form of alchemy and botany; the organization of Pharmacy; and the founding of hospitals.

THE ARABIC CONTRIBUTIONS TO MEDICINE

A—*Medicinal Chemistry*

The development of Arabic Medicinal Chemistry is the work of Geber's genius. It was he who distilled vinegar, sublimated sulphur, and crystallized mercury, and put all known compounds into his furnaces, sublimating pots, and retorts. Geber was the champion of therapeutic sobriety in contrast with the extravagant practices of the apothecaries in his day.

Following the path of alchemy, the Arabs discovered a whole fascinating world of drugs, including alcohol, sulphuric and nitric acids, silver nitrate, mercury bichloride, naphtha, benzoin, camphor, saffron, myrrh, laudanum, and potassium.

While the rest of Europe was busy with prayer, the Arabs were introducing alchemical techniques of crystallization, distillation, and sublimation, and were using anesthetics and practicing clinical medicine.

B—*The Organization of Pharmacy*

The Arabs organized Pharmacy, establishing two types of pharmacists: those who sold herbs, sirups, and simple medicines, and those who filled medical prescriptions. Arab pharmacies were supervised by an inspector who threatened the pharmacists with bodily punishment if they adulterated their drugs. Pharmacies were clearing houses for over five hundred drugs, not including their combinations. They also sold civet to Moorish women, and distilled water of orange blossoms, myrtle, roses, and carnations for physicians to wash their hands. And they sold honey, the most fashionable medical panacea, in the form of sirups which are still used today.

The pharmacies were also centers of information, conversation and culture, dispensers of news, gossip, and rumors, and popular academies where people were informed of medical progress. Many Arabic words which were later incorporated into our language, viz., alcohol, drug, alcali, sirup, sugar, spinach, alfalfa, admiral, arsenal, pillow, cipher, star, algebra, zero, zenith, and julep, were created during the interminable conversations held between the pharmacist and his customers while they gazed upon the spurting waters in the blue-tiled fountains surrounded by myrtle and sweet basil.

The pharmacist could immediately judge the importance of a physician calling on him by the height of his turban and the richness and length of the sleeves of his robe. Some physicians charged as much as 125,000 *duros* for a consultation and made as much as ten million *duros* in medical practice.

Bettmann Archive

Arabian physician, who is lecturing on snake poison, points to plants useful as antidotes. Copper engraving after twelfth century manuscript. Vienna.

Paradoxically, physicians tended to rely on the vegetable medicaments provided by nature, while pharmacists alternated the preparation of drugs with horoscope readings, allowing the stars and alchemical philosophy to rule their chemical manipulations. For the benefit of their credulous patients, pharmacies prominently exhibited bottles containing foeti, frogs, scorpions, owls, dissected crocodiles, as well as flasks with mysterious liquids. Even physicians frequently combined science with the necromancer's tricks.

Arab physicians and pharmacists were pioneers in chemistry and pharmacology, for, driven by a consuming ambition to find the philosopher's stone that would transmute lead into gold or silver, they did extensive experimentation which led to the development of the basic methods in chemistry, viz., distillation, sublimation, calcination, and filtration. They also experimented with their drugs on animals. Rhazes, for instance, tried mercury on monkeys.

The Arabs also invented the art of filling prescriptions, an art inherited with few changes by our modern pharmacists. They introduced sirups, juleps, oils, poultices, court plasters, pills, powders, alcoholates, and aromatic waters. They discovered a form of surgical anesthesia consisting of a sponge soaked in narcotic and aromatic substances which the patient sucked or inhaled before an operation. *The Thousand and One Nights* abounds in stories involving hypnotic drugs probably inherited from Chinese pharmacology.

To the Arabs then belongs the glory of having created medicinal chemistry, for the Greek attempt at chemistry was limited to casting metals.

Another contribution made by Arabic pharmacy was the manufacture of drug jars and bottles that were veritable works of art. The ancient Egyptian alabaster vases for ointments, the square Roman glass boxes for poultices, the Persian vessels embellished with figures of animals and fruits, were all outdone by Arabic ceramics, the result of a flourishing pharmacy. These Arabic ceramic jars were richly colored and ornamented with fruits and leaves, the same motifs used on jars for preserves and marmalades, and on tiles and majolica; they had such artistic value that later they were copied by Italian craftsmen. When Caliph Harun al-Rashid wished to present Emperor Charlemagne with a gift, he chose the finest Arabic majolica jars which he filled with ointments.

C—*The Founding of Hospitals*

The Arabs further contributed to medicine by founding magnificent hospitals in Djondisapur, Bagdad, Damascus, Cordova, and Cairo. The Mansur Hospital in Cairo had separate wards for men and women, wards for general diseases, and wards for eye diseases. For patients with fevers, it boasted of wards decorated with fountains so that the patients might be soothed by the spouting water.

The hospital was an immense quadrilateral construction with four courtyards, and it had such features as lecture halls, a library with six librarians, chapels, and an asylum for the poor along with a dispensary and a kitchen, all attended by qualified male and female nurses. Day and night fifty reciters intoned the Koran aloud. At nightfall, musicians played soft melodies to induce a sweet drowsiness in

the patients. Professional story-tellers entertained the sick with their tales. When the patient left the hospital he was given enough money so that he would not have to resume work immediately. The hospital was completed in 1384 by carpenters who had come from Egypt, but even the people passing by the hospital were forced to help in its construction, thus making a compulsory contribution to a good cause.

In the year 1160 Bagdad had more than 60 hospitals, according to an old Jew who traveled there at that time. The same year saw the foundation of the famous hospital of Damascus which for three centuries cared for the sick gratis until in 1427 it was destroyed by a fire. Bagdad also had several insane asylums, where patients were treated with a gentleness and kindness never known before. All hospitals were also centers of medical teaching where new techniques were tried out, such as the use of cautery instead of the scalpel, which became the basis of Arabic surgery.

There were also many special hospitals for eye diseases; the Arabs were particularly interested in the eye, not only because of its religious symbolism ("the eye of Providence"), but because of the preponderance of blindness due to "Egyptian ophthalmy," or tracoma, and other eye diseases caused by perennial sand storms. This explains why Ophthalmology made greater progress than other facets of anatomy or physiology, and it provides a good example of how a sociological need forces the progress of a given branch of medicine. The Arabs, however, dared not go so far in their meticulous study of the eye as to violate the religious ban on dissection.[18]

In the eleventh century the Arabs published the *Book of Alhazen*, the most important treatise on Optics in the fifteen centuries between the Alexandrian period of Euclid and Ptolemy and the initiation by Kepler and Newton of modern Physics. All this progress in Ophthalmology was made empirically, for when the Arabs operated on cataracts, for example, they were not even aware that they were removing a darkened lens.

Thus, through the great medical figures in the Eastern Caliphate, the Arabs bequeathed to the West a rich legacy in botany, pharmacology, pharmacognosy, and chemistry, together with the organization of hospitals and alchemical techniques. And in the Western Caliphate of Moslem Spain, Arabic medicine, propelled by the genius of a few Arabigo-Spanish physicians, achieved new scientific and cultural heights.

COLOPHON

Such, then, is the imprint made on History by the Arabs during the centuries that witnessed the birth, the growth, and the decline and extinction of their mighty empire. The plain Mohammedan farmer and the warring nomad Bedouin, who led a primitive existence with but the barest necessities of life, after they reached strange lands developed into a highly civilized people who knew how to adapt themselves, how to create comfort and luxury, and how to nurture the seeds of an art and a science that had classical roots but gave forth genuine Mohammedan blossoms.

Deep within themselves, however, the Arabs remained a primitive people who preferred the barren desert to the verdant oasis, for they knew that it is in the desert—

bereft of everything but sky and sand—that man may truly face himself and his Creator. This nostalgia of the western Arab for the life of the nomad was reflected in the *casidas* of eleventh century Andalusia, the melodies that influenced the poets of Dante's times and inspired the lyrical poetry of Shakespeare's predecessors.

We have seen in the foregoing pages the rich medical legacy left by the Arabs. Perhaps this legacy was not as indelible as that of other Oriental nations; nevertheless, to the Arabs, besides the medieval monks, we owe all the medical progress made during the many years of darkness in medieval Europe. More than creators, the Arabs were "transmitters and transmuters" of classical science. But then, in those periods in history when there are no creators, the work of the transmitter acquires the importance of a bridge that offers the only path for Civilization and Science to continue their journey.

At the end of the journey of Arabic civilization there was a night as Shahrazad could never have dreamed about. It was the night *one thousand and two*, in which Medicine was illuminated by the dawn of the Renaissance.

NOTES

1. This and subsequent quotations are from *The Thousand and One Nights*, Sir Richard F. Burton's translation, New York: Heritage Press, 1934.

2. Ultimately, Nestorius retired to an oasis in Lybia where he died.

3. Actually Arabic medicine is a misnomer since Persians, Syrians, Spaniards, Jews, and Copts contributed to it; it should rather be called Moslem or Islamic medicine, for it was not racial characteristics but the religious banner and the Arabic tongue that provided the unifying forces.

4. In the year 794 a paper factory was established in Bagdad.

5. The Jews exercised a considerable influence on Arabic medicine since they figured prominently at the courts of the Caliphs. A common belief in an inner monotheism created strong ties of sympathy between the Mohammedans and the Hebrews. Another point of contact was the fact that Hebrew and Mohammedan physicians, with their gift for analysis, intensive thinking, and appreciation of values, soon developed a materialistic way of looking at concrete things. Thus while Christian physicians were preoccupied with spells, amulets, saints' relics, and superstitions, most Jewish and Mohammedan physicians considered such things with deep distrust.

During the Middle Ages and for a long time thereafter Hebrew physicians suffered varied fates. When the Persian King Cosroes established the school of Djondisapur in Arabistan, Jews as well as Christians were invited to teach; by the time the Islamic Empire had spread from Mecca to Finisterre, the Jews had gained ascendancy at the court of the Caliph Moavia I. In the tenth and eleventh centuries they were a sort of forbidden luxury, much sought after by princes and bishops because of their superior abilities but often harshly treated for religious reasons. The Jews also distinguished themselves as translators of Greek works, and greatly contributed to the foundation of the School of Salerno, where Ben Salim translated Rhazes. In 1267 the Council of Vienna prohibited them from practicing among Christians. Under the Western Caliphate they were highly respected in Spain. When they were exiled from Spain in 1402, the School of Salerno engaged them as teachers but only until it was able to proceed on its own without outside help. The same thing occurred in Montpellier, which closed its doors to Jews in 1301.

6. Ali al-Tabari was a contemporary of Hunain, son of Sahl, the Persian-Jewish scholar. He wrote on cupping and amulets, and composed a manual called *Paradise of Wisdom* in which he discussed pathology from the head to the toes. He compared his book to a garden which should not be viewed from the gate but by strolling along its walks.

7. Haly Abbas, a Persian magician, was born of a Zoroastrian family. His *Liber Regius* is a 4,000,000-word compendium of the entire medical knowledge of the Arabs in the tenth century.

8. Rhazes was the first to describe and differentiate between smallpox and measles. He treated more than a thousand patients for sciatica, studied hiccough and the origins of jaundice, wrote the first treatise on pediatry, introduced several drugs, studied gonorrhea thoroughly, described seton application and pupilar reflex to light, wrote monographs on poliomyelitic endemia, tuberculous fistular osteitis, and eruptive fevers, and even studied the allegorical dreams of his patients.

9. Avicenna's clinical observations are worthy even of our times, especially his comments on the physiology of dreams, the purification of water, medical ecology, dietetics, urethral medication, the use of vaginal plugs, oral anesthetics, the treatment of insanity by artificially induced malaria, tic douloureux, tetanus, pleuritis, the contagious nature of tuberculosis, anthrax, and diabetes mellitus.

Like other Arab physicians, Avicenna did not practice dissection of the human body because of religious reasons, and his anatomy therefore is Galenic. He used surgery only in extreme cases, preferring cautery to the scalpel. The application of cautery lasted until Ambroise Paré rejected it, lessening thereby the suffering of the wounded but increasing the number of infections. Which proves that progress in medicine is not always made in a straight line but often by detours.

10. To the north of the Caliphate of Cordova—which from 756 to 1031 embraced the major part of the Iberian peninsula—were the Visigothic kingdoms of Asturias, Leon, Castile, Navarre, and Catalonia, which were focuses of continuous rebellion during Moslem domination. The frontier lay to the south of the Duero River, and Aragon was in enemy territory. In 1150 this frontier had shifted down to the Tagus River, and in 1276 all that remained of Moslem Spain was the small kingdom of Granada.

Toledo swarmed with Arab manuscripts and became a great center for translators, eventually eclipsing Cordova in medicine, philosophy, and theology. Archbishop Raimundo of Toledo (?–1150) formed a society of Hebrew translators under the direction of Archdeacon Dominicus Gundisalvi, which later was converted into an institute for Saracen studies under Christian tutelage.

11. The *cante jondo*, a style of singing often associated with the Spanish gypsy, is a symbol of the Spanish soul. Semitic winds carried its melodies from Oriental shores to the Mediterranean coast of Andalusia. On the soft, dark Andalusian soil, while guitars played under proud cypresses and kind olive trees, Moorish and Christian tresses became entangled with Jewish tresses. When the braid was completed, it cracked like a whip into the popular soul. Thus was the *cante jondo* born.

12. The legend of a medicine that could cure one out of every six lepers would later be considered (by Boerhaave) as an allegory of the philosopher's stone that could transform the six basic metals of the world into gold.

13. Albucasis extracted arrows from the bodies of wounded men and ligated arteries to stop hemorrhages. He was the first to describe the position for lithotomy on women and to treat fractures with bandages. He performed transversal tracheotomies and differentiated between thyroid cancer and ordinary goiter.

14. In his book *Theizir* Avenzoar describes the acarus that causes scabies; he therefore could be considered the first parasitologist. He also described serous pericarditis and pharyngeal paralysis. He practiced tracheotomy on sheep, used artificial feeding through a catheter introduced in the esophagus, and treated hernia by prescribing baked bread, boiled sparrows, two months' rest "without even praying except in the heart," submerging the patient in milk to feed him through the pores, and giving him food enemas. He claimed that "the interpreter of the soul of the brain is the tongue, and the most noble of the senses is the eye."

15. Among Maimonides' most famous works are his translation into Hebrew of the *Canon* of Avicenna, his medical aphorisms, his treatise on poisons and their antidotes, another treatise on asthma, and particularly his treatises on dietetics which he wrote in the form of letters to al-Malik al-Afdal, son of the Sultan Saladin of Egypt.

Al-Malik al-Afdal was a neurotic young man continually worried about his health. The silvery sounds of the lute played by expert players, the dancing girls with their bodies shining in the scarlet light of the torches, the love songs and the red wine, none of these amused him. Obsessed by his health, he consulted Maimonides, the court physician. The letters Maimonides wrote almost eight hundred years ago to his royal master, giving him advice on how and what to eat, have become immortal. Despite their naive simplicity, they are of such practical value that any modern physician might recommend them as a popular code of dietetic hygiene.

"Man," said Maimonides in these letters, "should lead a life pleasing to God, should do nothing to

harm his health, and should eat and drink only when it is necessary. He should always eat a little less than he requires to surfeit himself; he should have very little water during his meals and during the period of digestion, and the little he does drink should, if possible, be mixed with wine." On this point Maimonides agreed with nutrition experts who have established the daily quantity of wine to be taken at only fifty grams. "If possible," Maimonides continued, "before eating the body should be rested, warmed by a bath, and evacuated; one should not eat in a sitting position, and never walking or riding; nor should one do exercise or hard work in the four hours that follow the meal."

Maimonides appreciated the value of the same fruits which modern hygiene considers most nutritional: "Good fruits—grapes, almonds, figs, melon are good laxatives and should be eaten alone shortly before the meal; they should not be eaten from the tree or when they are dry or green, and never become too dependent upon them." Maimonides was probably thinking of the risk of too much sugar, a caveat of modern medicine.

"Eat," advised the good Maimonides, "what is easily digestible, fowl rather than ox-meat and beef rather than the meat of the bull. In the summer or in warm climates eat cold meats, acid foods, and no spices. In winter and cold climates eat very hot food, rich in mustard and spices," (thus laying the basis of caloric diets). "These are harmful foods which should be avoided: large salted fish, old cheese [danger of fermentation?], pungent foods, young wine, and foods that are bitter or too fragrant. Nor would I recommend milk more than a day old, meat from an old ox, peas, unleavened bread, onions, and radishes. Of all the foregoing eat little and only in the winter. Never eat dried beans or lentils; have honey and wine in moderation and only in the winter, and never give them to children."

Then Maimonides went on to discuss regulation of the intestines, a prosaic but necessary preoccupation, and one that was of great importance among the Arabs. "Always try," he said, "to combat constipation; with this view in mind, young people should eat foods with a great deal of salt and oil and vegetable soups, and old people should take honey with hot water in the morning. Above all," he insisted, "be temperate. Solomon said that he who stands guard over his mouth and tongue avoids many ills."

He advised against the excessive use of venesection, which was then very much in fashion. He also gave advice about bathing. "Take a hot bath at least once a week. Never bathe in cold water, except if you make it cold gradually; do not bathe while digesting your food, nor when hungry; cover your head to avoid drafts; during your bath drink watered wine or water with honey instead of plain water, and then rub your body with oil, and rest." What more could a contemporary hygienist in a hydrotherapy clinic say?

Finally Maimonides advised against sleeping during the day: "Only at night should one sleep and for eight hours, waking at dawn; one should sleep first on the left side and then on the right. He who follows these rules," his letters concluded, "will live long without infirmities; but if he is ill he should consult a doctor: if he does so, he will die from old age without needing one."

16. The most ancient diagram in existence of the human eye is to be found in a manuscript of the Arab Hunain ibn Ishak.

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INCORPORATING INTERNATIONAL RECORD OF OPHTHALMOLOGY

FOREWORD

The objective of the QUARTERLY REVIEW OF OPHTHALMOLOGY is to bring together in one publication concise but authoritative abstracts of current articles on ophthalmology, according to an all inclusive plan which includes all special, state, and national journals as well as the bulletins of clinics, hospitals, etc., and the transactions of meetings. This embraces both the domestic and foreign literature.

To assist the reader to locate quickly the articles of current interest all data are classified and published according to the following systematic plan:

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A section entitled International Record of Ophthalmology is included at the beginning of the journal. The Record Section consists of advanced clinical and experimental reports.

Quarterly Review of **OPHTHALMOLOGY**

The Use of Subconjunctival Corneo-scleral Suture in Cataract Extraction

Dr. D. Joaquin Barraquer Moner
CLÍNICA BARRAQUER
BARCELONA, SPAIN

In 1949 we published an article in which certain surgical highlights in the technique of cataract extraction were stressed. The purpose of this paper is to emphasize the type of suture employed as the results were very gratifying.

For the past two years, we have used two new methods of subconjunctival suturing which we have classified as techniques IV and V.

Virgin silk, essentially composed of seven cocoon threads held together by a substance called sericina, is employed. This silk is extremely fine and dyeing it with methylene blue facilitates its identification in the operative field. Special needles are used with this silk. They are manufactured by Grieshaber (model 83), and measure 4 mm. in length (figure 1). The eye of the needle is made in proportion to the thickness of the silk. The point of the needle and its cutting edge are similar to those previously used (model 81/5 and 81/7), (figure 2), though the former is slightly thinner. In order to properly grasp these needles and to prevent them from being injured, a special needle holder with fine points should be used (figures 3 and 4).

OPERATIVE PROCEDURES

SUBCONJUNCTIVAL SCLERAL SUTURE: TECHNIQUE NO. IV

The conjunctival flap is elevated and the needle passed through both lips of a scleral incision which has been made previously. It is important that the needle and the silk be passed through both ends of the scleral lips with one thrust and that the entrance and exit of the needle coincide in height and position. The conjunctiva is not included, but when consequently replaced completely covers a buried suture (figure 5).

SUBCONJUNCTIVAL CORNEO-SCLERAL SUTURE: TECHNIQUE NO. V

In those cases in which a limbal section is made, a corneo-scleral suture is put in place. For this purpose, the conjunctival flap is first elevated and a double arm suture is used. The entrance of the needle is first made through the corneal lip to the right of the 12 o'clock meridian. The scleral lip is then engaged and it emerges

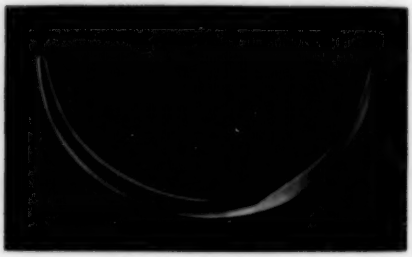


FIG. 1 (left) Special Grieshaber needle (model 83).

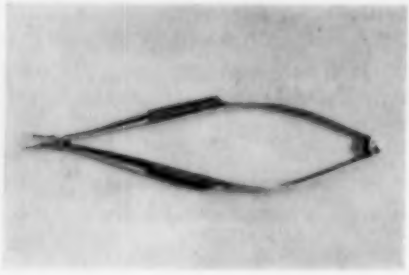
FIG. 2 (right) The usual Grieshaber needles (models 81/5 and 81/7) compared with the actual model 83.

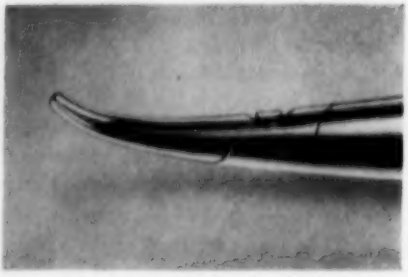
1 or 2 mm. posteriorly. A similar suture is also placed to the left of the 12 o'clock meridian. One must be careful that the entrance and exit of the silk coincide exactly in height and position in order to obtain perfect coaptation. By this method a U-shaped suture is obtained whose base is intracorneal and whose sides are intrascleral. We have again established a subconjunctival suture (figure 6).

The advantages of the subconjunctival suture are: (1) It minimizes friction which results in quiet healing of the cataract wound. (2) The elements of the silk are completely tolerated by the eye, produce no irritation, and thereby eliminate the necessity of removing the suture.

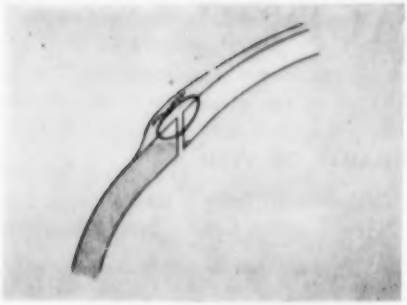
At the first dressing on the fourth or sixth postoperative day the eye appears to be free of undue reaction and the sutures are no longer distinguishable. The methylene blue which impregnated the silk, being an organic material, has been perfectly assimilated by the organism and has disappeared without producing any reaction.

Once the above sutures are put in place, it is beneficial to fix the conjunctival flap with a solution of plasma and thrombin. In order to utilize the "surgical paste," the conjunctival flap has to be inverted over the cornea and after drying with a special brush, a drop of human plasma of double concentration is deposited upon it. Shortly after, a solution of thrombin (500 U. per cc.) is instilled and the lips of the conjunctival wound are reunited with the help of two forceps. After 10 to 15 seconds





FIGS. 3 and 4 (left and right) Needle holder with fine points to prevent injury to needles.



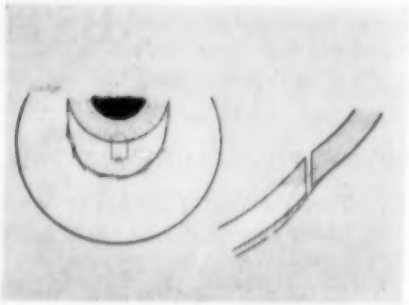


FIG. 5 (left) Subconjunctival scleral-scleral suture.
FIG. 6 (right) Subconjunctival corneo-scleral suture.

have elapsed, it is prudent to irrigate the conjunctival sac with physiologic saline to remove the coagulated remnants. The solution of plasma thrombin not only contributes to the fixation of the conjunctival flap but at the same time completes and determines what we may call the network of the wound.

More than 600 cataract operations using the above described sutures have been performed without having had any case of intolerance to the material, January, 1955. If perchance a suture is not well covered by the conjunctiva, it can be easily removed after 20 days when practically no danger to manipulation exists. We also wish to emphasize that these threads and needles can be used in radial end to end corneal suturing in corneal grafting.

The fineness of the needles and the silk permit the placing of 16 sutures in a perforating keratoplasty of 6 mm., with the trauma reduced to a minimum and with the guarantee of a perfect wound coaptation.

Because the silk constitutes a minimal foreign body, it can remain in situ 15 or 20 days without producing any disturbing effects. When the sutures are eventually removed, the resulting corneal scar has consolidated perfectly and there is practically no danger of rupturing the wound during this delicate act.

SUMMARY

Two methods of subconjunctival suturing have been described. These sutures have the following advantages: (1) The silk suture employed is perfectly tolerated by the eye and consequently does not require its removal. (2) The suture produces an absence of friction and quiet postoperative wound healing is obtained. (3) The type of silk employed lends itself particularly well for direct or radial end to end corneal suturing of the graft in keratoplasty.

ABSTRACTS

OPTICS, PHYSIOLOGY AND PSYCHOLOGY OF VISION

29. *The Sensitivity of the Eye to Spectral Radiation at Scotopic and Mesopic Intensity Levels.* JO ANN SMITH KINNEY, New London, Conn. Spring Meeting Optical Society of America, April 7-9, 1955.

A scotopic luminosity curve was determined for each of five observers by finding thresholds for spectral radiation for a 2 degree field at a retinal position 10 degrees from the fovea. Mesopic spectral sensitivity curves were established for this retinal position by finding the amount of energy at each wave length necessary to produce a brightness match with a standard. The standard was monochromatic light of 530 $m\mu$ at three intensity levels—2, 3, and 3.5 log units above scotopic threshold.

The scotopic luminosity curves for all observers are smooth with their peaks at 510 $m\mu$ and a regular decrease in sensitivity on both sides of this peak. The average curve for four of the observers, 30 years of age and under, agrees with the C.I.E. scotopic curve for young observers.

Evidence on three issues about spectral sensitivity in the mesopic range is found in the results of this experiment:

1. The changes in relative spectral sensitivity, as intensity is increased above scotopic threshold, are heightened sensitivity, first to the red wavelengths at 2 log units above threshold, and then to the yellow and yellow-greens at 3 log units above threshold. Since the relative response to the shorter wavelengths does not change appreciably at these levels, the effect of the greater sensitivity to the long wavelengths is an increase in the area under the curve.

2. These data show that, from threshold to 3.5 log units above threshold, with conditions favoring rod sensitivity, the spectral sensitivity curves remain basically scotopic in shape, with little or no shift away from the scotopic maximum at 510 $m\mu$.

3. Humps and depressions are found in the mesopic curves, modifying the basic scotopic curve. These irregularities, at 470, 530, and 610 $m\mu$, agree with those found in photopic spectral sensitivity.—*Author's abstract.*

30. *Effect of Flash and Field Luminance upon Human Reaction Time.* N. R. BARTLETT AND S. MAC LEOD, Geneva, N. Y. J. Optic. Soc. America. *44*: 306–311, April 1954.

Reaction time is measured from the onset of a signal flash to the manual release of a microswitch. Responses are made by two trained subjects over wide ranges of stimulus intensity and under varying conditions of signal flash and background field luminance.

Two types of experimental conditions prevail: variable flash luminance at each of three field levels and variable field luminance at three constant flash intensities. Thirty-six reactions are collected for every flash-field combination at each of two fixation positions (foveal and peripheral).

The results are described by the following equation:

$$T = \frac{1}{B \log I/I_0} + K,$$

where B, I_0, and K depend upon the field luminance. 9 references. 6 figures. 3 tables.—*Author's abstract.*

31. *Testing Aniseikonia with a Simplified Space Eikonometer.* A. HARRY MALIN. Am. J. Optom. & Arch. Am. Acad. Optom. *32*: (1) 30-40, January 1955.

Ames' original space eikonometer consisted of an aperture board, target elements, background screen, suitable light source, and test lens apparatus. Each component, with the author's mechanical design for some of the elements, is described. Induced-size effect is a stereoscopic response caused by a retinal image inequality in the vertical meridian, a phenomenon which can make the apparatus inadequate, but which is avoidable. To prevent measuring aniseikonia which is caused by cylindric test lenses—"cylindrical excess magnification",—it is advantageous to measure the error based upon the spectacle lens correction. Screening devices for detecting aniseikonia have been made but are not considered clinically useful. Once it is established that a patient's symptoms result from malfunction of the eyes, then aniseikonia may be suspected after correction by the usual methods does not suffice.

The author tested 63 patients of whom 28 were given iseikonic lenses. Of these 28, 20 were definitely benefited, two found some slight help and use the prescribed correction, 5 were unsuccessful, and one remains unreported.—*Author's abstract.*

32. *The Nature and Cause of Impaired Vision in the Amblyopic Eye of a Squinter.* EARL A. MILLER. Am. J. Optom. & Arch. Am. Acad. Optom. *31*: (12) 615-623, December 1954.

Experimental evidence is presented to show that the impaired visual acuity in amblyopia can be merely a manifestation of impaired brightness discrimination. The data obtained with an amblyope are compared with those obtained with a normal subject.

The brightness difference threshold was measured using a narrow slit, the width of which could be varied. The minimum perceptible separation was measured using two bright slits on a dark background with a variable interval between them.

It is suggested that the basic cause of impairment in amblyopia is the absence of inhibition in the retina, which leaves the spread of excitation unsubdued. It is believed that the amblyopic fovea behaves like a peripheral part of a dark-adapted, normal retina at low levels of brightness.—*Author's abstract.*

33. *A Note on True and False Image Projection.* J. I. PASCAL. Am. J. Optom. & Arch. Am. Acad. Optom. *31*: (12) 636–638, December 1954.

The nonfoveal (false) image during a phoria test is projected correctly, i. e., according to the intrinsic local sign of the retinal area stimulated. Similarly, the inclined retinal image in a cyclophoria test is projected as an inclined image in space also according to the normal (true) projection of the meridian stimulated. The inclination of the projected after-image, which is opposite to what one would expect, may be regarded as due to a false projection, but only with reference to the primary position of the eyes. With reference to the oblique position of the eye, this too is true (normal) projection, although frequently termed false projection.—*Author's abstract.*

34. *Brightness Difference in Seeing.* SYLVESTER K. GUTH AND ARTHUR A. EASTMAN. Am. J. Optom. & Arch. Am. Acad. Optom. *31*: (11) 567–577, November 1954.

The visibility of a visual task, object against its background, is increased with increased illumination, up to a limiting value generally well above present day lighting practices. Changing the illumination changes the brightness of the background and the object, and thus changes the brightness difference between them. Brightness difference is a significant index in evaluating the effectiveness of illumination.

Suprathreshold measurements with the Luckiesh-Moss visibility meter of objects at various foot-candle levels with different combinations of object and background reflectances were compared with absolute threshold measurements. Similar objects having the same contrast with their backgrounds may be widely different in visibility since a contrast can be obtained with an infinite variety of combinations of background and object reflectances. It is shown that to obtain a given visibility level for similar tasks with a given contrast, however obtained, the illumination level for each task must be such that the brightness difference is the same for all the tasks. These results emphasize the importance of brightness and brightness difference as a major factor in seeing.—*Author's abstract.*

OCULAR MOVEMENTS AND MOTOR ANOMALIES NYSTAGMUS READING DISABILITY

35. *Inducement of Cyclofusional Movements.* V. J. ELLERBROCK. Am. J. Optom. & Arch Am. Acad. Optom. *31*: (11) 553–566, November 1954.

The inducement of cyclofusional movements has been the object of several recent investigations. However, in these studies attention was directed to the response of the eyes to relatively small angular rotations of the images. In this experiment rotations of the images to the limit of cyclofusion were employed and the nature of the movements during inducement especially noted.

For accurate measure of the response of the eyes, stereoscopic localization of two small point of light sources was used. This method permitted very accurate objective results and also provided for correlation of objective findings with the subjective reports of spatial localization by the subject.

One of the most important results was the asynchronous response of the eyes. This finding was unexpected; no explanation is offered for the varying discrepancy between the rotation of the images and the response of the eyes. The amplitudes of cyclofusional movements in general exceeded 26 degrees. This finding was considered exceptional with a target of a single white line.—*Author's abstract.*

36. *Investigation of the Nature and Cause of Impaired Acuity in Amblyopia.* EARL FRED MILLER, II. Am. J. Optom. & Arch. Am. Acad. Optom. *32*: (1) 10–29, January 1955

Five patients with amblyopia in one eye have been investigated. Measurements were made of visual acuity using both Snellen letters and parallel bar test objects.

Brightness discrimination was also measured with a narrow rectangle. The effect of varying the width of the rectangle was investigated. It was found that the range through which an increase in width lowers the threshold is much wider in the case of an amblyopic eye than in a normal eye. The same sort of effect that is found in an amblyopic eye occurs in a normal eye when short flashes are used.

It is suggested that a mechanism of inhibition, which is present in the normal eye, is missing or defective in the amblyopic eye. It is proposed that this approach to amblyopia can be used to determine ahead of time what can be achieved by visual training.

ANOMALIES OF REFRACTION AND ACCOMMODATIONS; CONTACT LENSES

37. *Accommodative Response in Asymmetric Convergence.* RICHARD W. SPENCER AND W. KEITH WILSON. Am. J. Optom. & Arch. Am. Acad. Optom. *31*: (10) 498–505, October 1954.

A review of the literature pertaining to experimentation in accommodative response to unequal stimuli both in the mid-sagittal and asymmetric positions of fixation is presented.

The results of response measurements by stigmatoscopy in asymmetric convergence with both monocular and binocular fixation of the target are opposite for the two observers to a statistically significant level. Neither observer approaches the calculated difference in stimuli to accommodation of 0.31D when viewing binocularly. The data tend to support that of Ogle, Stoddard, and Morgan, but not the data of Rosenberg, Flax, Brodsky, and Abelman. With monocular fixation the accommodative response is related more to the eye fixing than to the direction. The possibility that the dioptric system may offer a compensating process for image

size differences as suggested by Ogle and the implications concerning Hering's law are discussed.—*Author's abstract.*

38. *Physiological Factors in Multifocal Corrections. I. Measurement of Ocular Functions.* ROBERT E. BANNON. Am. J. Optom. & Arch. Am. Acad. Optom. *32*: (2) 57–69, February 1955.

This paper aims at reviewing the physiologic factors that may be measured routinely in clinical practice and strives to make them the basis for determining the near point prescription. The routine measurement of the amplitude of accommodation by the "push-up" method and the "minus sphere" test, as well as the use of the "dynamic cross cylinder" test for determining the presbyopic add are discussed. The findings of these tests determine a tentative correction for the patient's preferred near working distance; this is refined by the "method of limits" which equalizes the dioptric ranges of clear vision. The procedure effects a correction that leaves half the amplitude of accommodation in reserve.

The loss of accommodative convergence occasioned by an add for near vision necessitates increased fusional convergence. This usually presents no problem to presbyopic patients if they are given adequate time to make the adjustment to the new correction. Some clues are given on how to detect patients who have difficulty in developing adequate fusional convergence.

It is emphasized that in anisometropic cases, measurement of vertical phorias with and without glasses, is the only sure way of determining vertical imbalances at the reading level. Physiologic adjustments and inherent anisophorias frequently make it unnecessary to prescribe for the differential prismatic effects of anisometropic lenses. A simple procedure for measuring the distance and near phoria is described.

In general, this brief exposition attempts to outline a simple procedure for determining near point or multifocal corrections which the average practitioner can use with full confidence in its scientific and clinical validity.—*Author's abstract.*

CONJUNCTIVA

39. *Epidemic Keratoconjunctivitis.* H. L. ORMSBY AND ANN M. C. FOWLE, Toronto, Ontario, Canada. Am. J. Ophth. *38*:490–495, October 1954.

In the spring of 1951 an epidemic of epidemic keratoconjunctivitis occurred in the Ford motor plant in Windsor, Ontario. Of the 549 patients who reported for treatment at the plant hospital, only 89 developed corneal opacities which could be seen by focal illumination with the aid of a binocular loupe. Eye washings from these patients were stored in the CO_2 chest, and at a later date attempts were made to isolate the virus by the technique of Sanders and Alexander. None of the attempted isolations on these cases was successful.

During the winter of 1951–1952, a number of cases of epidemic keratoconjunctivitis were seen in the Toronto area. Attempts were made to isolate the virus

from fresh unfrozen washings taken from the eyes of these patients. A number of mice became sick from the early tissue culture passages from these washings, but it was not possible to establish strains of virus by further passage of brains from these sick mice.

Strains of mice encephalomyelitis virus were isolated in six out of 10 attempts to isolate the virus of epidemic keratoconjunctivitis. The factors involved in the activation of these viruses were the use of cortisone in the inoculated mice, the observation of the mice for a period of one month after intracerebral inoculation, and the serial passage of the embryonic mouse brain.

Sixty-one sera from patients who had recovered from epidemic keratoconjunctivitis in the Windsor epidemic of 1951, and eight sera from patients in the Toronto area who had recovered from the disease, failed to show neutralizing antibodies to the Sanders-Braley strain of epidemic keratoconjunctivitis virus. It would appear that this virus, originally isolated in 1942 by Sanders and Alexander, is not related to the virus responsible for the present outbreaks. In view of the neutralization of this strain of virus by St. Louis encephalitis hyperimmune serum, one must consider the possibility that the original virus had been lost or contaminated in storage. 6 references. 2 tables.—*Author's abstract.*

40. *The Present Status of Epidemic Keratoconjunctivitis.* T. AIDAN COCKBURN, Greeley, Colo. Am. J. Ophth. *38*:476–485, October 1954.

The present day knowledge of keratoconjunctivitis is critically reviewed. For after some years of obscurity, the disease has become prominent again as the result of recent epidemics and fresh isolations of virus. In North America 13 epidemics have been reported in the literature; these are analysed in tabular form. Some of them have been substantial, with 10,000 cases in Hawaii in 1941 and 40,000 cases in Schenectady in 1942.

Clinically, the disease consists of a conjunctivitis which may be mild, moderately severe, or very severe, followed by a keratitis. Any discharge is slight and nonpurulent. Pain is usually mild or absent in the early stages, but is often severe during the keratitis. The pre-auricular glands are often enlarged. Opacities in the cornea are a feature of the disease, but the percentage of patients who develop them varies from one epidemic to another.

Laboratory studies have concentrated on the isolation of a virus and several successes have been reported. These claims are examined in detail and the conclusion reached that no agent available today in North America can be reliably regarded as the etiologic agent of the disease.

Epidemiologically, the disease is worldwide in distribution, though the succession of events would suggest that during World War II it spread from Asia to Hawaii, from California to New York state. There are three main types of spread—among people in close contact with one another, as in families; among patients attending the offices of ophthalmologists, with the infection presumably being transmitted by the physician himself, and in large industrial plants, by some means as yet not understood. The location of the virus between epidemics is not known, but several possibilities are discussed.

The disease is a hazard to all who work with eyes, but no fundamental understanding of it can be achieved until a satisfactory strain of the causal agent is obtained. It is urged that a study be set up with the collaboration of all concerned to achieve this, as well as to clarify the methods of spread of the infection, the revaluation of ophthalmologic techniques that might be implicated, diagnosis, and treatment. 20 references. 4 tables.—*Author's abstract.*

ANTERIOR CHAMBER AND PUPIL

41. *The Pupillary Reactions and Their Pathology.* MANUEL D. MARIN-AMAT. Arch. Soc. oftal. hispano-am. *14*:166–197, February 1954.

A comprehensive review of the literature on the anatomy, physiology, and pathologic changes of the pupillary reactions is given.

The author's observations were made in a tuberculosis hospital using patients with tuberculous meningitis. Among 84 patients with tuberculous meningitis, he found 18 cases of pupillary dilation to light after a brief preliminary constriction. These occurred in untreated or inadequately treated patients. This anomalous reaction is attributed to a toxic paresis of the parasympathetic, so that the tone of the dilator of the pupil is increased through the impotence of the sphincter of the pupil. In response to light there is an attempt at contraction followed by an immediate dilation. Out of 100 patients examined hippus of the pupil was found in 3 cases of tuberculous meningitis. A rare disorder in dilatation of the pupil of the fellow eye may occur when one eye is exposed to light. This was observed in a 15 year old girl with fatal tuberculous meningitis shortly before she died, and in a man, 43 years old, with papillitis and other pupillary disturbances.

UVEAL TRACT AND SYMPATHETIC OPHTHALMITIS

42. *A Study of the Role of Toxoplasmosis in Adult Chorioretinitis.* A. C. WOODS, L. JACOBS, R. M. WOOD, AND M. K. COOK. Tr. Am. Acad. Ophth. & Otol. *58*:172, March–April 1954.

Toxoplasma may be incriminated as the etiologic agent in a considerable percentage of granulomatous uveitis cases. Of 201 cases studied, toxoplasma was indicated to be the etiologic factor in 58, of which 17 were probably congenital and 41 acquired in adulthood.

A dye test study was conducted of serums of a large number of nongranulomatous and granulomatous uveitis patients and a group of nonuveitis control subjects. In the nonuveitis control group and the nongranulomatous uveitis group, where there is no thought of toxoplasma infection being related to the ocular disease, about 25 per cent positive dye tests were found. The granulomatous uveitis group in which any possible toxoplasma ocular involvement would fall revealed 45 per cent positive dye tests, a statistically significant higher incidence. In the latter group the

positive dye tests were generally higher than in the other group and all cases of rising titer on repetition of the tests were found in the granulomatous uveitis patients. Among the patients with granulomatous uveitis the greatest number of positive tests occurred in cases of disease of "undetermined etiology." The incidence of positive dye tests was 56 per cent in this group. Where the uveitis had been attributed to recognized conventional etiologies, the incidence of positive tests was around 25 per cent, essentially the same as the control and nongranulomatous uveitis group.

The authors conclude that adult acquired ocular toxoplasmosis is an actual clinical entity and that the condition is not confined to the congenital disease found in children. Toxoplasma infection is the probable etiologic factor in approximately 25 per cent of adult granulomatous uveal disease. The diagnosis of a toxoplasma etiology can be made only by careful consideration of the clinical ocular picture, evaluation of the results of a medical survey, and serologic and cutaneous toxoplasma tests. There appears to be a 20 to 25 per cent margin of error in evaluating a single positive dye test as an index of toxoplasma etiology.

43. *Sympathetic Ophthalmia.* ADMARDO ROCHA DE SOUZA. Rev. brasil. oftal. *13*: 181–196, September 1954.

The various theories on the development of sympathetic ophthalmia are reviewed. The interval between the injury and the development of sympathetic ophthalmia is observed to be from nine days (Joy) to 30 or 40 years or more. The clinical characteristics, the histopathologic findings, and the prognosis are reviewed. The author believes that once a diagnosis of sympathetic ophthalmia has been made, then immediate treatment with the antibiotics, "stock vaccines," autohemotherapy, mercurials, arsenicals, and sodium salicylate is indicated. The action, use, and limitations of ACTH and cortisone are discussed. Three cases of sympathetic ophthalmia are reported by the author, in which there had been penetrating injuries of the blind eye three months, five years, and 12 years before the examination. In each case, enucleation of the blind eye was carried out, and a definite improvement in the vision of the sympathetized eye was noted.

44. *Metastatic Carcinoma of the Iris.* C. H. GREER, London, England. Brit. J. Ophth. *38*:699–701, November 1954.

Only 6 cases of intra-ocular metastatic carcinoma are recorded in which it has been histologically verified that the secondary tumor was confined to the iris alone. Two additional cases are described here from among 45 cases of secondary uveal carcinoma recorded in the archives of the Institute of Ophthalmology, London (1935-1954).

One case was in the right eye of a man of 67 years whose only complaint was of a gritty feeling in the eye for two days. There was little evidence of intra-ocular inflammation. The patient died two months later. On section the tumor proved to be an adenocarcinoma, possibly from the lung or thyroid, although the primary growth was not detected.

The second tumor, which was an anaplastic carcinoma, occured in the right eye of a man 76 years old with a carcinoma of the lung in the right upper zone. Pain developed in the eye following pneumonia. Death occurred eight months later.

The relevant literature is briefly reviewed. 11 references. 2 figures.—*Author's abstract.*

CRYSTALLINE LENS

45. *Biologie du cristallin.* JEAN NORDMANN, professeur de clinique ophtalmologique à la Faculté de médecine de Strasbourg. Présenté à la société française d'ophtalmologie, mai, 1954.

This report is divided into two parts. Part I deals with the normal lens, its embryology, anatomy, physical properties, aberrations (optical and chromatic), and mechanical characteristics. There is a thorough discussion of the inorganic and organic chemistry, vitamins, enzymes, intracrystalline metabolism, electrolytic efforts and factors, and mechanism of accommodation. Two excellent photographs taken from Cattaneo demonstrating the state of the zonules in the presence and absence of accommodation are most instructive.

Part II is augmented by excellent and numerous photographs. The pathologic congenital anomalies are thoroughly and minutely discussed. All of the well known types of cataract are fully and adequately described. Some of the old and now discarded medical treatments of cataract such as potassium iodide and cyanide of mercury injection, ethyl-morphine, phacolysin or cataractolysin, estrogen-androgens, lens extracts (fish, bovine, and human), parathyroid extract, calcium gluconate, and vitamin D are mentioned.

The author states that since none of these methods can be scientifically evaluated, it is the ophthalmologist's duty to give the affected patients the maximum comfort. At the end of each chapter, conclusions are enumerated and there is a complete bibliography. This is an excellent unabridged report for the student of ophthalmology who can read French.

46. *Postnatal Cataracts in Premature Infants; Report of Two Cases.* LOREN P. GUY, New York, N. Y. Am. J. Ophth. *38*:65–68, July 1954.

Two cases of cataracts which developed between the third and sixth months in premature infants are reported. Another case which had been found after the manuscript was presented was also mentioned. Each of the children had been exposed to high concentrations of oxygen though no general contributory disease such as galactosemia was found. There were no hereditary factors nor prenatal diseases of the mothers.

Since only premature infants were examined no opinion regarding the condition in full term infants could be formed and as careful study of the eyes of premature infants from birth is a recent venture, it is not known whether the cataract formation is something new or not. The cataracts found resemble some types of

congenital cataracts and were so diagnosed by those who did not know the history of the cases. Possibly similar cases found in the past have been assumed to be congenital. 1 figure.—*Author's abstract.*

RETINA

47. *Present Status of Retrolental Fibroplasia.* J. W. MORESIDE. Bull. Acad. Med., Toronto. *27*: no. 5, 118–123, February 1955.

Retrolental fibroplasia is the greatest single cause of blindness in preschool children in Canada. Hyperoxygenation seems to be a factor in its development.

There are 67 cases of retrolental fibroplasia in Ontario registered with the Canadian National Institute for the Blind. In 51 of these cases the birth weight was between 3 and 4 pounds. In Canada there are 326 blind preschool children registered with the Canadian National Institute for the Blind, 143 of these are blind due to retrolental fibroplasia.

48. *The Problems of the Rutin Effect in Diabetic Retinopathy.* F. MEHLHOSE, Klin. Monatsbl. f. Augenh. *125*:5–13, 1954.

Sixty-nine patients with diabetic retinopathy were treated with rutin. No impressive effect could be noted. This is in contrast to another German report in which the therapeutic and prophylactic use of rutin was advocated (Niedermeyer, *Klin. Monatsbl. f. Augenh.*, 121, 1952). The prophylactic use of rutin is expensive and of no proven value. Its local application could be an acceptable solution.

49. *Effect of Oxygen on Developing Retinal Vessels with Particular Reference to the Problem of Retrolental Fibroplasia.* N. ASHTON, B. WARD AND G. SERPELL. Brit. J. Ophth. *38*:397, July 1954.

In the preliminary study of the 32 experiments here reported, 121 kittens and 41 mother cats were used. Seven new born rabbits and 91 ratlings with their mothers were also used in the investigation. When the animals were killed one eye was studied with India ink injection of the vessels and the other without this injection. The entire retina was mounted for study. It was found that high concentrations of oxygen at atmospheric pressure are able to induce a type of vasoconstriction in the growing retinal vessel of the kitten which progresses to complete obliteration of the vessels. This newly-described phenomenon is apparently confined to the developing retina. The severity of vaso-obliteration is inversely proportional to the maturity of the vessels, and obliteration cannot be produced once the retinal vasculature is fully mature. On transfer to air the obliterated vessels only partially re-open, producing hemorrhages, and a grossly abnormal vascular pattern. This partially re-opened network is inadequate to nourish the retina, and profuse vasoproliferation develops. Several factors which might influence this course of events were studied, notably hyperoxia, hypoxia, and carbon dioxide.

50. *Pathological Basis of Retrolental Fibroplasia.* N. ASHTON. Brit. J. Ophth. *38*:385, July 1954.

The conclusions drawn from a study of the microscopic pathology of 4 early cases agree with those of most workers that retrolental fibroplasia is a primary retinal disease of noninflammatory origin, resulting from a derangement of retinal vascularization. The author disagrees, however, with the theories of a few that this disease can occur prenatally. He states that the development and course of the disease may be simply outlined in three pathologic stages, and defines the first stage as the early extension into the vitreous of vasoformative tissue which has erupted through the internal limiting membrane. Contending that many of the proliferative retinal changes described in the literature lose their significance when this strict criterion is adopted, he points out that none of the stillborn or short-lived premature infants considered in this study showed any stage one pathologic changes. Of equal significance was the fact that, out of his entire collection of 280 cases investigated clinically, histologically, or both, there was not a single example of retrolental fibroplasia where oxygen had not been administered therapeutically.

It was noted that since the basic cause of the disorder is merely an abnormal overgrowth of the developing retinal vessels, it is not impossible that there might be a variety of precipitating causes. Nevertheless, cases of retrolental fibroplasia of the type which has emerged as a clinical entity during the last 10 years occur in premature infants who develop the disease postnatally in circumstances related to the administration of oxygen. The author comments that there would be a solid basis for applying a special name to the oxygen-induced disease, but suggests that a revision of nomenclature should await clarification of the problems of pathogenesis.

NEURO-OPHTHALMOLOGY OPTIC NERVE, VISUAL PATHWAYS, CENTERS AND VISUAL FIELD

51. *Optic Atrophy of the Infant Following a Prepartum Hemorrhage.* MARCELO CARRERAS. Arch. Soc. oftal. hispano-am. *14*:405-414, April 1954.

A 4 year old child was blind from an incomplete bilateral optic atrophy. The mother had had a severe uterine hemorrhage which lasted four days after childbirth and the optic atrophy is attributed to the anoxemia which followed the hemorrhage. The pathogenesis of anoxemia in the tissues of the fetus after maternal hemorrhage differs from that of ocular anoxemia in the adult after a severe hemorrhage, in that the direct anoxemia of the adult is always accompanied by a variable degree of hypoproteinemia, while in the child the blood protein is normal.

There is a latent period between the hemorrhage and the onset of the optic atrophy of several days and the author suggests that repeated ophthalmoscopic observation of the newborn might uncover the onset of the lesion and institute prompt therapy. This form of atropic atrophy is always incomplete and not progressive. Vision improves considerably within the first six years of life, and slightly

between 6 and 12 years of age. There is scarcely any perceptible improvement after the age of 12.

Treatment consists of dietetic measures, vitamin B, and liver extract. Antibiotic therapy is useless. Prophylaxis consists in prompt delivery when there is severe hemorrhage, in blood transfusions of the mother, and in intense antianemic therapy.

52. *Pregnancy Complicated by Ocular Chiasmatic Signs of a Meningioma in the Sella Turcica.* G. BOCCI. Boll. d'ocul. *33*:158–171, March 1954.

During her third pregnancy, an otherwise normal 38 year old woman developed severe loss of central vision and extensive visual field defects, and finally characteristic bitemporal hemianopia and optic nerve atrophy. One and one-half years previously, both optic nerves were normal but there was a relative central scotoma in the right field and right central vision was reduced to 5/15. In the seventh month of pregnancy a premature delivery was induced; vision and fields continued to fail. Fifteen months later a meningioma of the tuberculum sellae turcicae was removed surgically.

53. *Tobacco-Alcohol (Toxic) Amblyopia.* H. W. MAXWELL. Texas State J. Med. *49*:137, March 1953.

Two cases of tobacco-alcohol amblyopia have been presented showing lowered general health, probably due to improper diet, partial loss of central vision, bilateral scotomas, inability to distinguish red and green traffic lights, and few, if any, ophthalmoscopic findings.

By diminishing their tobacco and alcohol consumption slightly and with a proper diet, including vitamin B_1, one patient made complete recovery and the other made a partial recovery.

It is not possible to say to what extent tobacco and alcohol were causative factors, but it seems from the results that the vitamin B_1 deficiency was the most important factor of the three.

These cases again emphasize the importance of doing careful field studies.

54. *Juvenile Amaurotic Idiocy in Norway.* A. J. NISSEN. Nord. med. *52*:1542–1546, November 4, 1954.

Juvenile amaurotic idiocy, or Vogt-Spielmeyer's disease, was described in Norway as early as 1826 by Stengel, who reported 4 cases in siblings. It is a degenerative familial disease. Inheritance seems to be recessive. The affection is characterized by increasing blindness, epileptic seizures, and increasing dementia, with death in the course of a few years. The anatomic substrate is a degenerative condition in the nervous system. The disease belongs in the group of lipoidoses. The children are born well and overtaken by this disease at about school age.

The 10 eyes examined by the author are from four families in the vicinity of

Trondheim. Two of the families are from mountain districts in the geographic section in which the cases reported by Stengel occurred. The causative hereditary substance has presumably been present in the locality for some time back.

55. *A Quantitative Comparison of the Prism-Jump and the Tangent Screen Method of Plotting Scotoma.* CHARLES LAWSON. Am. J. Optom. & Arch. Am. Acad. Optom. *31*: (12) 639–645, December 1954.

The prism-jump method of detecting retinal areas of reduced sensitivity was described by Dr. S. Rodney Irvine in the American Journal of Ophthalmology, 1944, *27*:740–746. The present study has been conducted to observe patient response to the prism-jump test and to compare quantitive measurements obtained by the prism-jump method with measurements of the size of scotomata plotted by the usual tangent screen method.

The results indicate that, in a given meridian, the value of the weakest prism which produces diplopia is very nearly the same as the size of the scotoma determined by the mean between the points at which, using the usual tangent screen method, the moving target disappears and re-appears. The difference between measurements made by the two methods was found to be less than one centimeter and, therefore, negligible for clinical purposes.

The author suggests that the prism-jump test may be of special clinical value in detecting and plotting a central scotoma because it does not necessitate the use of a mirror device to obtain steady fixation.—*Author's abstract.*

GLAUCOMA AND HYPOTONY

56. *Routine Tonometry as Part of the Physical Examination.* R. W. ZELLER AND L. CHRISTENSEN. J. A. M. A. *154*:1343, April 17, 1954.

A considerable percentage of the blind and near-blind patients examined at the outpatient clinic of the University of Oregon medical school had passed unrecognized through practitioners' offices, clinics, and hospitals while their disease was in an active phase. This was particularly true of chronic glaucoma. Approximately 2 per cent of persons over 40 years of age, an estimated two million persons in the United States, have chronic glaucoma and do not know it. The most common sign of glaucoma, increased ocular tension, can be detected quickly in the practitioner's office with any of several types of tonometer.

During the period from July 1, 1951 to June 30, 1952, a study was conducted on interns and patients to determine whether interns without a special interest in ophthalmology could be trained to determine ocular tensions with reasonable accuracy, using a standard Schiotz tonometer. The 12 interns reported a total of 1,000 determinations, 60 of them over 25 mm. Hg. Seventeen of the 60 were verified. None of the reported normals was found to be abnormally high on spot checks. The 17 patients with confirmed high tensions were then referred to the eye clinic for further study and treatment. It was the impression of the ophthalmology faculty that any intern who had taken more than just a few tonometric

measurements was able to perform the test accurately. Determination of ocular tension as part of the routine physical examination offers the best means of discovering glaucoma in the 2 per cent of the population over 40 years of age who have the disease. The concept of what constitutes a complete physical examination must include tonometry before the one million undiagnosed glaucoma patients can be detected.

57. *Meterologic Influences on Ocular Diseases.* W. GERLOFF. Klin. Monatsbl. f. Augenh. *125*:61–71, 1954.

This analysis is based on 64 attacks of acute glaucoma which occurred since 1950. If the attacks which were precipitated by a known factor, death of a relative, or a quarrel for example are excluded, there is a peak of incidence between September and January and again in July. One case of expulsive hemorrhage occurred while a cyclone was approaching. Also, in cases of chronic glaucoma, there was a correlation between the variations in the intra-ocular pressure and the changes in the weather.

58. *Carbonic Anhydrase Inhibitor Acetazoleamide (Diamox). A New Approach to the Therapy of Glaucoma.* GOODWIN M. BREININ AND HEINZ GÖRTZ. A. M. A. Arch. Ophth. *52*:333, September 1954.

Breinin and Görtz have observed that some cases of glaucoma appear to be controllable indefinitely on small doses of diamox. The optimal dosage is 500 mg. in the morning and 250 mg. at night, continued until the pressure is normalized, and then changed to either 500 mg. in the morning or 125 mg., four times a day. A maintenance schedule of 125 mg. four times a day appears to be satisfactory.

MEDICAL OPHTHALMOLOGY

59. *Fundus Lesions with Disseminated Lupus Erythematosus.* M. BRIHAYE-VAN GEERTRUYDEN, P. DANIS, AND C. TOUSSAINT, Brussels, Belgium. Arch. Ophth. *51*:799–810, June 1954.

A case of lupus erythematosus is reported by the authors, who have been able to observe fundus lesions for one year, and to make post mortem histologic examination of the eyes.

This has confirmed the previously rare observations of retinal lesions in lupus erythematosus made by six authors that the "cotton-wool" white spots visible with the ophthalmoscope are due to conglomerations of cytoid bodies situated in the nerve fiber layer of the retina.

The protracted course, interrupted by remissions, the frequency of the ocular examinations, and the availability of histologic material provided an unusual opportunity to make an exact study of the course of the disease.

The authors establish:

1. There is a parallelism between the appearance of the retinal spots and the aggravation of the general state.

2. The "cotton-wool" exudate lesions have a cyclic evolution—appearance of a soft spot, sharpening of ophthalmoscopic appearance, period of stabilization, repression, and disappearance.

This cycle does not appear to have any connection with the evolution of the general state nor with the treatment.

It is concluded that the causal factor of the retinal lesion determines simply the appearance of the cytoid bodies, but not their evolution. 38 references. 10 figures.—*Author's abstract.*

60. *Experimental Diabetes Mellitus and the Eye.* G. ALAGNA. Arch. di ottal. *58*:203, May-June 1954.

After reviewing the literature concerning the ocular complications of experimental diabetes, the author summarizes his own investigations as follows (without describing the details of his experiments): in alloxan diabetes, cortisone aggravates and desoxycorticosterone alleviates the symptoms, including the lenticular opacities. In Ditizone diabetes, BAL, nicotinic acid, riboflavin, vitamin E, and particularly ACTH have an ameliorating effect on the development of cataract and chorioretinitis. While similarities exist between the diabetogenic cataract of experimental animals and man, the same cannot be said of the diabetic retinopathy as yet.

61. *Ocular Manifestations of Niemann-Pick Disease.* C. MALATESTA. Boll. d'ocul. *33*:368–378, June 1954.

An 11 year old girl with a large liver and spleen, turrecephaly, positive Bence-Jones reaction, and severe cachexia, two months before her death, showed a cherry red spot in the fovea of each eye, surrounded by a large, barely elevated gray area, three disc diameters in diameter. The relationship between Niemann-Pick disease and Tay-Sachs syndrome is discussed.

62. *Retinopathy as Part of a Diabetic Angiopathy.* W. PORSTMANN AND J. WIESE. Klin Monatsbl. f. Augenh. *125*:336–354, 1954.

A total of 720 diabetic patients is evaluated. Among them were 326 patients with fundus changes. There was a definite connection between the duration of the diabetes and the appearance of the retinopathy. Arteriosclerotic changes in the vessels occurred more frequently in diabetic patients than in the general population; 80 per cent of the patients with retinopathy had signs of a Kimmelstiel-Wilson disease of the kidney.

63. *The Ocular Symptoms of Acrodynia.* J. CASANOVAS AND J. DOMENECH. Arch. Soc. oftal hispano-am. *14*:131–140, February 1954.

The literature is reviewed, and 2 cases reported. The characteristic symptom of the disease is an intense photophobia without any organic lesion to account

for it. The authors report 2 cases, one a child of 9 months, who recovered under therapy with vitamins and liver, and the other an infant of 11 months, who recovered under treatment with vitamin B_6 and Bellergal.

PHARMACOLOGY, TOXICOLOGY AND THERAPEUTICS

64. *Ocular Penetration of Erythromycin.* E. I. QUERENGESSER AND H. L. ORMSBY. Canad. M. A. J. *72*: (3) 200–202, February 1955.

Erythromycin ointment applied topically to the conjunctival sac of rabbits resulted in average aqueous levels of 1.18 μg. per ml. Subconjunctival injections of 5 mg. of the drug produced aqueous levels of 2.43 μg. per ml.; injections of 10 mg. gave levels of 5.12 μg. per ml. Intramuscular injections of 25 mg. per Kg. produced serum levels of 3.01 μg. per ml. and aqueous levels of 1.66 μg. per ml.; intramuscular injections of 50 mg. per Kg. gave serum levels of 10.66 μg. per ml. and aqueous levels of 3.2 μg. per ml. 19 references. 1 table.

65. *Topical Cortisone in the Treatment of Syphilitic Interstitial Keratitis.* GORDON O. HORNE, Leeds, England. Brit. J. Ophth. *38*:699–672, November 1954.

Few reports on the use of topical cortisone in the treatment of syphilitic interstitial keratitis record more than short term results (less than a year). These have varied considerably, and doubt has been expressed as to the value of cortisone in this condition. In order to clarify the position, an analysis was made of 20 patients (26 eyes) treated with topical cortisone along with systemic antisyphilitic therapy. These were observed for periods ranging from six to 39 months after the start of treatment. The patients attended the Department of Venereal Diseases, General Infirmary, Leeds, between December, 1950 and January, 1954.

In nearly all of the cases the immediate results were excellent, but the principal method of assessment used was the final corrected visual acuity. In 36 per cent of the eyes this was 6/6 or better, in 52 per cent 6/9 or 6/12, and in 12 per cent 6/15 or 6/30. A comparison using this criteria with several other series from the literature in which cortisone was not used reveals the superiority of cortisone treatment. In the series described no contraindication to the hormone was revealed. The importance of adequate dosage is stressed. It is concluded that cortisone is an imperative method of treatment for syphilitic interstitial keratitis, and in well-managed cases the results should always be excellent. 5 references. 1 table.—*Author's abstract.*

66. *Treatment of Herpes Zoster Ophthalmicus with Cortisone or Corticotropin.* HAROLD G. SCHEIE AND MELVIN C. ALPER. A. M. A. Arch. Ophth. *53*:38, January 1955.

According to Scheie and Alper, cortisone and corticotropin seem to have exerted a favorable influence on herpes zoster ophthalmicus in the 11 patients reported

in this paper. Relief of pain usually occurred in one to two days. Therapy with these hormones suppressed signs of ocular inflammation, such as iritis and keratitis, but was not curative as shown by the frequent recurrence of symptoms.

BOOK REVIEWS

The New Approach to Optical Dispensing. HARRY B. WATERS. Culver City, Calif., Murray & Gee, Inc., pp. 172.

This book is intended for dispensing opticians. However, it may prove shocking to many ophthalmologists when they learn that a patient requires a minimum of three pairs of glasses, and a presbyopic patient requires seven pairs of glasses. This will be the first time most ophthalmologists will learn that a patient requires regular bifocals, occupational bifocals, trifocals, tinted bifocals for driving, reading glasses, hobby glasses, and a pair of bifocals for evening wear.

There is a minimum of technical information. The author makes no reference to the sources of his statements, for instance: "Without colored glasses a patient is straining his eyes when he is outside in the sunlight." In fact there is no evidence for such a statement, which applies to the average person, unless his eyes are exposed to snow at high altitudes.

The purpose of this book is to show the optician how to make more and larger sales. It is not a new approach because high pressure salesmanship has been the practice of some opticians for many years. There seems to be no need for this book.—*Gerald Fonda, M.D.*

Clinical Manual on Aniseikonia. ROBERT E. BANNON. Buffalo, N. Y., Instrument Div., American Optical Co., 1954. pp. 120. Price $1.

This monograph presents a series of lectures given at various instruction courses since the close of the Dartmouth Eye Institute in 1947. The subject matter is confined to the clinical aspects of measuring and correcting aniseikonia.

The historical and developmental work in aniseikonia is reviewed briefly and the technique of space eikonometry discussed in detail. The 25 illustrative case reports are instructive in showing the clinical judgment used in prescribing refractive and aniseikonic corrections. The practical results of aniseikonic corrections and clues for the detection of aniseikonia are presented. These data are based upon the experiences of the Dartmouth group and other practitioners. A final section is devoted to helpful information on iseikonic lenses. A comprehensive bibliography is also included.

The material included in this manual will prove helpful not only to those actively engaged in the investigation of aniseikonia, but should also provide information which will guide the general practitioner in evaluating the clinical significance of aniseikonia in routine practice.

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